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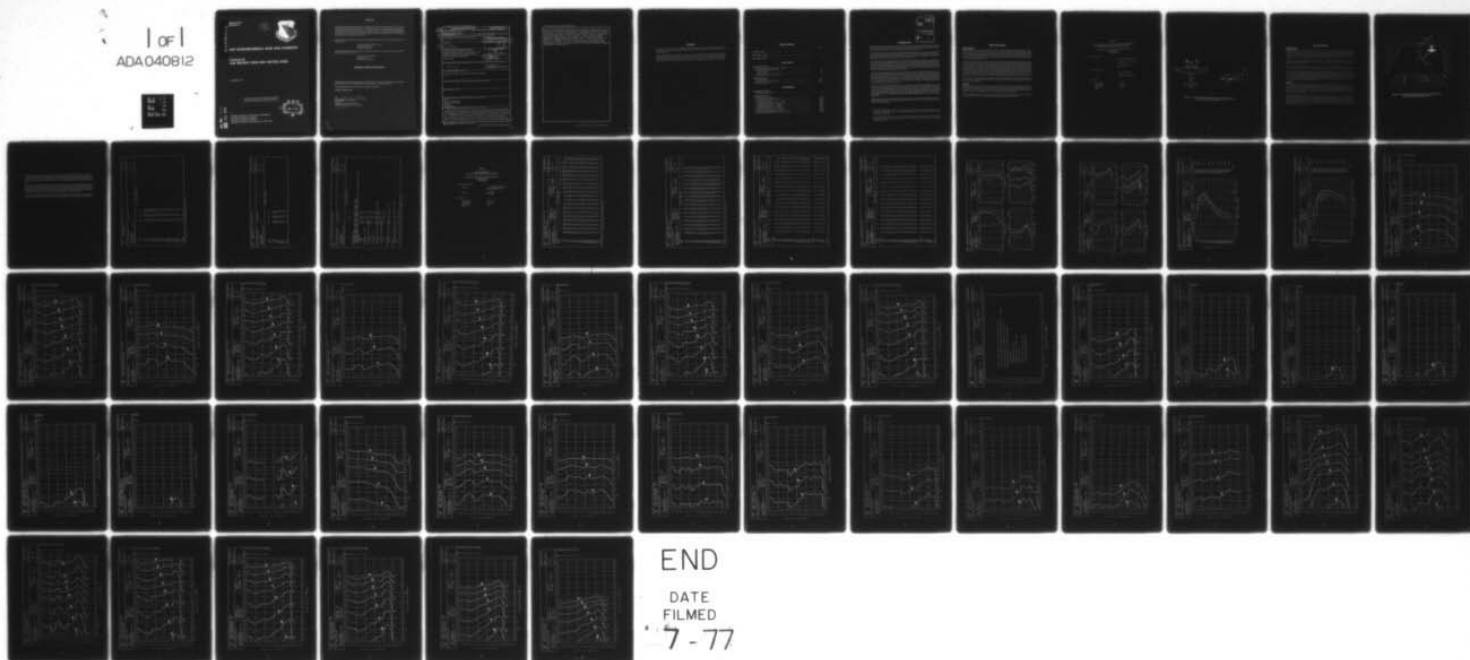
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AMRL-TR-75-50  
Volume 66

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# USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

## Volume 66 U-4B AIRCRAFT, NEAR AND FAR-FIELD NOISE

NOVEMBER 1975

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WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433



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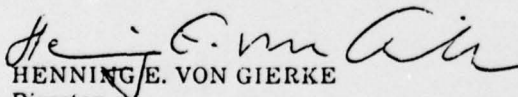
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FOR THE COMMANDER

  
HENNING E. VON GIERKE  
Director  
Biodynamics and Bionics Division  
Aerospace Medical Research Laboratory



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for total daily exposure of personnel with and without standard Air Force ear protectors. Far-field data measured at 19 locations are normalized to standard meteorological conditions and extrapolated from 50-8000 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application", AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

## **PREFACE**

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 723104, Measurement of Noise and Vibration Environments of Air Force Operations.

The author gratefully acknowledges Mr. John Cole for his assistance in preparing this report, Mr. Robert England for his assistance in acquiring the raw data, Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton for assistance in the mechanics of data processing and Mrs. Norma Peachey and Mr. Mike Patterson for assistance in typing and preparation of the graphics.

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## INTRODUCTION

The USAF U-4B Aero Commander is a utility-type aircraft powered by one each GS0-480-A1A6, B1B6 reciprocating engines. The aircraft was manufactured by North American Rockwell/General Aviation Division and the engines by Avco Corporation, Avco Lycoming Division.

This volume provides measured and extrapolated data defining bioacoustic environments produced by this aircraft during ground runup operations. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with ground runups of the U-4B aircraft.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and aerospace ground equipment. The far-field, community-type noise data in the handbook describe the noise produced during *ground operations* of aircraft, aerospace ground equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Volume 2 provides a method and data for adjusting the handbook's far-field noise data, which are for standard meteorological conditions (15°C temperature, 70% rel humidity, 0.760 meters Hg barometric pressure), to derive comparable data for other meteorological conditions. *Refer to Volumes 1 and 2* (references 1 and 2) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., inflight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of each updated index.

Direct any questions concerning the technical data in this report and other handbook volumes to: AMRL/BBE, Wright-Patterson AFB, OH 45433; AUTOVON 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.

1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.
2. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 2: Procedure to Evaluate Effects of Non-standard Meteorological Conditions on Far-Field Noise*, AMRL-TR-75-50 (2), AMRL, WPAFB, OH, 1975.



## NEAR-FIELD NOISE

### MEASUREMENTS

AMRL acquired near-field noise data on the U-4 aircraft during ground runup operations of its engines. For these tests the aircraft was located on a concrete runup pad at Peterson Field, Colorado Springs, Colorado with no significant reflecting surfaces in the vicinity except the ground plane. Table 1 gives the surface meteorological conditions and the two engine/power conditions. The ground-crew chief selected power conditions and near-field locations generally used during routine maintenance or engine runup for preflight checks.

At each near-field location a test engineer randomly moved a hand held microphone in and around each location, probing all areas where a crew member's head would normally be located. He recorded all of the noise samples on magnetic tape. During analysis of each sample, he determined the root-mean-square sound pressure using a 4- or 8-second integration time to derive a power-averaged level for each location. Figure 1 shows the three near-field locations where ground crews are usually located for maintenance and/or preflight checkout operations. Estimates of noise levels at other locations in the near-field are difficult since the noise source is spatially distributed, i.e., not a point source. The noise levels at near-field locations can vary widely depending upon relative distances from each noise source (propeller noise, exhaust noise, panel resonances, internal engine noise through the engine wall, etc.).

Table 1 lists the numeric/alphabetic designators used on the data pages in this report to identify the measurement locations and test conditions. For example, the designator 1/A means ground crew location 1 and test condition A.

### RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced by the U-4B aircraft at the three ground crew locations. This table includes the overall, 1/3 octave band, and octave band levels. From these data one can calculate the variety of measures given in Table 3, which are widely used to assess the effects of noise on personnel and their performance.

All near-field data are for the meteorological conditions at the time of test but are valid for all typical airbase meteorology because of the short sound propagation distances involved.



TABLE 1

MEASUREMENT LOCATIONS AND TEST CONDITIONS  
FOR NEAR-FIELD NOISE MEASUREMENTS

U-4B Aircraft, Ground Runup, Peterson Field, CO  
28 September 1972  
Tail #054648

*Ground Crew Location*

1	Engine #2 Start Fire Guard
2	Engine #1 Start Fire Guard
3	Wheel Chock Pull

*Aircraft Engine Operation*

A	Engine #2 Idle Power
B	Both Engines Idle Power

*Meteorology*

Temperature	12.2 C
Bar Pressure	.766 M Hg
Rel Humidity	50 %
Wind	Calm

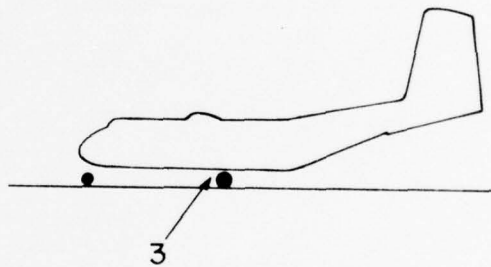
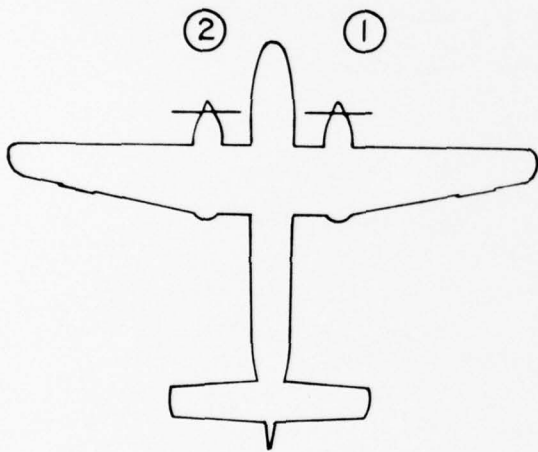


Figure 1. Near-Field Measurement Locations at North Runup Area,  
Peterson Field, Colorado Springs, CO

## FAR-FIELD NOISE

### MEASUREMENTS

AMRL acquired both near and far-field data during a 1-2-hour test period, thus keeping similar meteorological conditions. Figure 2 shows the ground runup pad, ground cover, aircraft orientation and the 19 microphone measurement sites on a semicircle. The center of the 30 meter radius semicircle used in surveying the GS0-480 engines was on the ground directly below the intersection of the aircraft's centerline and the plane passing through both engines' propeller planes.

Table 4 provides cockpit readouts of engine characteristics (RPM and manifold pressure) for each power setting used in the far-field tests. Also listed in this table are the surface meteorological conditions during data acquisition.

All 19 microphone measurement sites are in the acoustic far-field of their respective source where the sound wave-fronts spherically diverge and the noise source may be regarded as a point source.

A portable microphone/tape-recorder system was used to sequentially record the noise at each far-field location. The microphone was attached to a hand held pole, pointed at the source ( $0^\circ$  angle of incidence) and vertically scanned from 0.5 to 3 meters for a period of 5-10 seconds during data acquisition at each microphone location. These samples were then time-integrated to derive a root-mean-square sound pressure level. Vertical scanning and time-integrating together reduce anomalies frequently present in data acquired by a fixed height microphone.

### RESULTS

Table 5 lists the overall and 1/3 octave band SPL measured at the far-field locations under meteorological conditions at the time of the test. Data in all other figures and tables are based on these levels. These data were normalized to 100 meters distance and standard meteorological conditions ( $15^\circ\text{C}$  temperature, 70% relative humidity, 0.760 meter Hg barometric pressure) and used to derive the graphic data in Figure 3 which provides a compact summary of the far-field noise characteristics of the U-4B aircraft in a standard format.

Figure 4 and Table 6 present two basic acoustic measures, the acoustic power level and the directivity index, respectively. The acoustic power level describes the power radiated by the source as a function of frequency. The directivity index is a standard acoustical engineering measure that describes the geometric way in which the source radiates this power as a function of both frequency and angle from source. These basic source measures are primarily of interest for acoustical engineers and noise generation/control specialists.

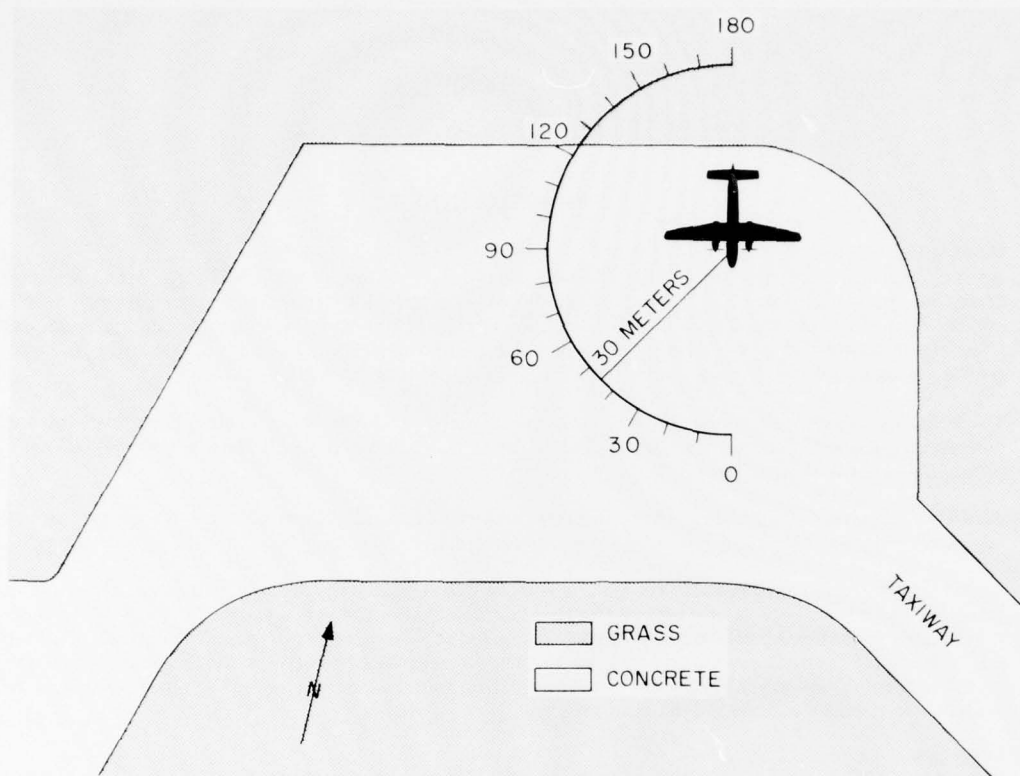


Figure 2. Far-Field Measurement Locations at North Runup Area,  
Peterson Field, Colorado Springs, CO

Figures 5 through 11 are sets of equal noise contours describing seven different measures of noise as a function of angle and distance from the source for standard day meteorology. They are respectively, overall sound pressure level, C-weighted sound level, A-weighted sound level, perceived noise level, speech interference level, permissible exposure times for personnel and octave band sound pressure levels.

Data excessively influenced by spurious background/electronic noise were eliminated from all figures and tables. Test personnel performed noise surveys during quiet periods when the background noise was minimal, e.g., early in the morning when no other aircraft or engine test stands were operating. Data eliminated because they were near the background/electronic noise were generally not significant because the levels were so low (e.g., Table 5 and Figure 11 at idle/taxi power).

Volume 2 of the handbook describes the influence of meteorology on far-field noise environments, and provides, if required, the factors necessary to adjust the handbook's standard meteorological day data.

&amp;ltlt LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.



TABLE: MEASURED SOUND PRESSURE LEVEL (DB)				IDENTIFICATION:	
2	OCTAVE BAND				
NOISE SOURCE/SUBJECT:				TEST 72-049-002	
				RUN 01	
				OMEGA 3.2	
				27 NOV 74	
				PAGE J1	
				LOCATION/CONDITION	
FREQ (HZ)	1/A	2/B	3/B		
31.5	93	94	104		
63	100	107	116		
125	100	101	110		
250	93	94	99		
500	88	91	95		
1000	85	86	89		
2000	82	83	88		
4000	77	80	86		
8000	74	78	85		
OVERALL	104	108	117		

TABLE: MEASURES OF HUMAN NOISE EXPOSURE				IDENTIFICATION:	
3				OMEGA 3.2	
				TEST 72-049-002	
NOISE SOURCE/SUBJECT:				OPERATION:	
U-48 AIRCRAFT					
GROUND CREW					
NEAR FIELD NOISE LEVELS					
				LOCATION/CONDITION	

\* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

TABLE 4  
TEST CONDITIONS  
FOR FAR-FIELD NOISE MEASUREMENTS

U-4B Aircraft, Ground Runups, Peterson Field, CO  
28 September 1972  
Tail #054648

*Aircraft Engine Operation*

Idle/Taxi	14 In Hg (Manifold Pressure) 1000 RPM Engine Speed
Military	48 In Hg 3400 RPM

*Meteorology*

Temperature	12.2 C
Bar Pressure	0.766 M Hg
Rel Humidity	50 %
Wind	Calm

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)																		
1/3 OCTAVE BAND																		
DISTANCE = 30 METERS																		
NOISE SOURCE/SUBJECT:																		
( OPERATION: ) METEOROLOGY: )																		
( IDLE/TAXI POWER ) TEMP = 12 C )																		
( 1000 RPM ) BAR PRESS = .766 M HG )																		
( BOTH ENGINES ) REL HUMID = 50 % )																		
( FREE FLOW ) )																		
FREQ																		
( HZ)																		
ANGLE (DEGREES)																		
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180																		
25	66<	68<	65<	64<	65<	65<	65<	65<	65<	64<	64<	64<	67<	63<	62<	66<	71<	70<
31.5	68<	68<	67<	68<	66<	67<	68<	68<	68<	67<	67<	67<	69<	68<	67<	68<	70<	72<
40	68<	68<	67<	68<	66<	67<	68<	68<	68<	67<	67<	67<	69<	68<	67<	68<	70<	72<
50	90	90	89	89	89	89	87	87	86	86	85	84	83	82	82	82	77<	73<
63	78<	78<	76<	78<	81	81	84	82	84	81	82	81	82	80<	77<	75<	73<	73<
80	74<	75<	74<	74<	74<	74<	74<	73<	74<	76<	76<	79	80	79	76<	75<	73<	73<
100	81<	82	82	79<	81<	83	82	83	80<	79<	79<	81<	83	83	81<	79<	77<	75<
125	85	83	87	90	91	91	85	84	83	84	84	84	84	83	84	83	81	80
160	80	79	78	81	84	85	84	84	83	84	84	84	84	83	84	83	81	80
200	71<	73<	73<	73<	75	75	76	77	77	77	78	79	78	80	81	80	78	76
250	75	76	77	79	81	81	80	80	78	79	79	79	78	80	81	80	78	77
315	76	75	77	77	80	79	77	78	77	78	79	79	77	76	77	80	81	78
400	74	74	71	73	75	70	74	71	74	74	76	74	74	74	74	75	70	69
500	71	70	69	69	70	71	71	68	68	68	69	69	71	71	71	70	72	66
630	71	69	68	66<	69	70	69	66<	68	69	70	70	71	71	70	69	69	62<
800	68	67	66	64<	67	65	66	62<	64<	64<	67	67	69	69	69	68	69	61<
1000	67	66	64	63	64	62<	62<	59<	62<	62<	66	67	70	69	68	70	68	62
1250	67	66	64	64	63	63	63	60	62	62	64	66	69	66	67	69	67	60
1600	63	63	62	62	61	62	61	60	60	62	62	62	64	65	66	70	67	58
2000	60	60	60	60	60	53	53	58	53	53	58	60	61	65	65	69	66	57
2500	58	58	59	58	57	57	57	56	56	56	57	57	60	65	65	67	65	55
3150	56	58	57	57	57	57	56	56	56	56	57	59	61	66	64	67	62	52
4000	56	56	57	56	56	56	55	55	55	56	56	59	61	64	66	64	63	59
5000	54	55	55	54	55	55	54	54	55	57	59	62	64	67	66	67	62	58
6300	52	54	54	53	53	53	52	52	53	54	58	61	64	67	65	64	60	48
8000	50	51	52	50	51	51	51	51	52	54	57	61	64	66	64	63	59	49
10000	45<	46<	48	46<	47<	47<	47<	46<	47<	48	53	57	59	60	59	59	56	44<
OVERALL	92	92	92	93	95	95	93	92	93	94	94	93	93	93	93	92	90	87

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)																		
1/3 OCTAVE BAND																		
DISTANCE = 30 METERS																		
NOISE SOURCE/SUBJECT:																		
( OPERATION: )																		
( MILITARY POWER )																		
( 3400 RPM )																		
( BOTH ENGINES )																		
( FREE FLOW )																		
METEOROLOGY:																		
TEMP = 12 C																		
BAR PRESS = .766 M HG																		
REL HUMID = 50 %																		
PAGE 2																		
IDENTIFICATION:																		
OMEGA 1.4																		
TEST 75-002-050																		
RUN 02																		
30 MAY 75																		
PAGE 2																		
FREQ																		
( HZ )																		
ANGLE (DEGREES)																		
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180																		
25	72	70<	72	70<	71<	72	73	75	75	77	75	76	78	77	78	77	78	
31.5	72<	73<	76	75	74	75	75	75	73<	74	75	77	77	78	77	78	78	
40	76<	78	78	77	77	77	79	77	76<	77	79	81	81	81	80	80	79	
50	81	80	80	81	81	81	83	83	83	84	83	83	82	83	81	82	82	
63	80<	80<	80<	82	83	83	84	84	85	85	84	86	87	87	86	83	82	
80	87	87	86	93	99	102	104	104	104	105	106	106	107	107	105	100	94	
100	101	103	101	100	99	101	103	104	105	108	111	112	113	113	107	99	99	
125	91	94	94	93	94	94	94	93	96	100	101	102	105	105	100	92	93	
160	99	99	95	98	104	105	107	105	103	105	107	109	111	111	111	109	110	
200	99	99	100	101	101	103	101	100	101	103	104	103	105	103	102	98	99	
250	98	104	107	107	101	109	112	107	104	108	108	112	116	117	110	103	101	
315	110	109	104	105	103	106	103	104	104	106	107	105	107	106	107	102	103	
400	106	104	105	105	100	106	107	104	108	108	108	109	113	115	110	101	102	
500	107	106	103	102	104	104	105	106	107	108	109	107	109	111	110	99	102	
630	106	105	104	104	104	104	106	107	106	108	109	109	111	112	112	101	103	
800	105	104	102	101	102	104	104	105	104	107	106	107	110	111	113	102	103	
1000	100	100	96	99	100	100	99	99	101	104	106	106	109	111	113	101	102	
1250	100	99	97	98	98	97	98	98	98	99	101	104	107	110	109	100	101	
1600	99	98	96	96	96	96	97	99	100	100	100	99	104	109	109	99	99	
2000	98	97	98	96	95	95	97	98	100	99	102	102	105	109	109	99	100	
2500	97	96	96	95	95	95	97	98	100	101	102	104	106	108	107	98	99	
3150	95	94	94	93	94	94	96	97	99	100	102	104	105	108	107	97	98	
4000	93	93	93	92	92	93	94	96	97	98	101	103	105	106	105	94	97	
5000	92	91	90	91	91	92	93	95	97	97	99	100	104	106	103	94	96	
6300	90	89	89	89	90	90	92	94	95	96	98	99	102	104	101	92	95	
8000	87	86	87	87	87	88	90	92	93	94	96	97	100	102	100	90	92	
10000	83	83	83	83	84	85	86	86	86	89	90	92	93	97	99	86	89	
OVERALL	115	115	113	113	113	115	117	115	116	118	119	120	122	123	122	114	115	

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.



TABLE: DIRECTIVITY INDEX (DB)										IDENTIFICATION:									
6										OMEGA 1.4 TEST 75-002-050 RUN 01									
NOISE SOURCE/SUBJECT:										METEOROLOGY:									
( OPERATION:										TEMP = 12 C									
( IDLE/TAXI POWER										BAR PRESS = .766 M HG									
( 1000 RPM										REL HUMID = 50 %									
( BOTH ENGINES										30 MAY 75									
( FREE FLOW										PAGE 4									
FREQ										ANGLE (DEGREES)									
( HZ)																			
1/3 OCTAVE																			
25																			
31.5																			
40																			
50																			
63																			
80																			
100																			
125																			
160																			
200																			
250																			
315																			
400																			
500																			
630																			
800																			
1000																			
1250																			
1600																			
2000																			
2500																			
3150																			
4000																			
5000																			
6300																			
8000																			
10000																			
OCTAVE																			
31.5																			
63																			
125																			
250																			
500																			
1000																			
2000																			
4000																			
8000																			
OVERALL																			





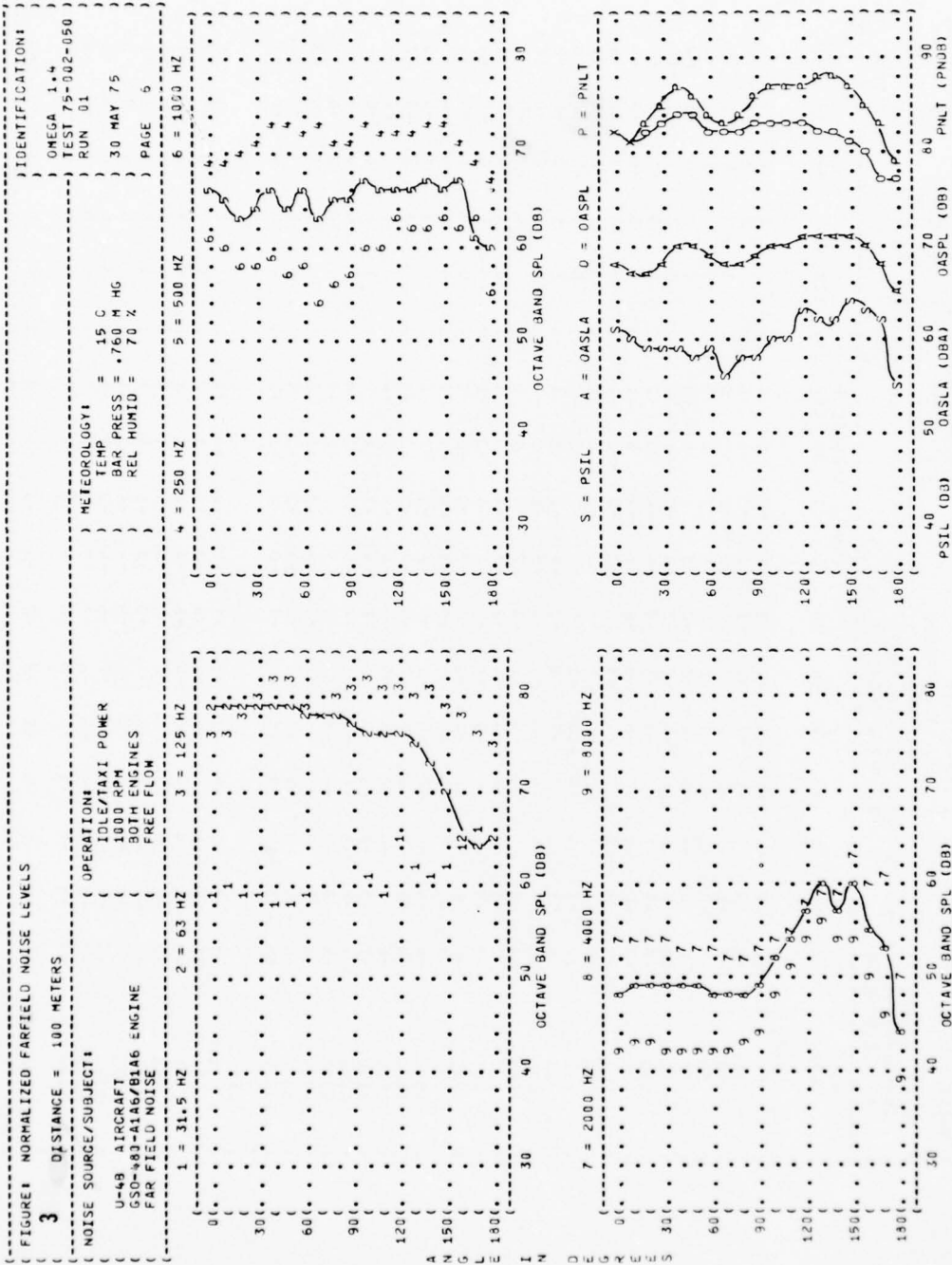




FIGURE: ACOUSTIC POWER LEVEL (PWL)

4

IDENTIFICATION:

OMEGA 1.4

TEST 75-002-050

RUN 01

30 MAY 75

PAGE 3

NOISE SOURCE/SUBJECT:

OPERATION:

IDLE/TAXI POWER

1000 RPM

12 C

U-4B AIRCRAFT

GSO-480-A1A6/B1A6 ENGINE

BOTH ENGINES

BAR PRESS = .766 M HG

FAR FIELD NOISE

FREE FLOW

REL HUMID = 50 %

METEOROLOGY:

TEMP

REL HUMID

U = OVERALL

3 = 1/3 OCTAVE

1 = OCTAVE

0 = OVERALL

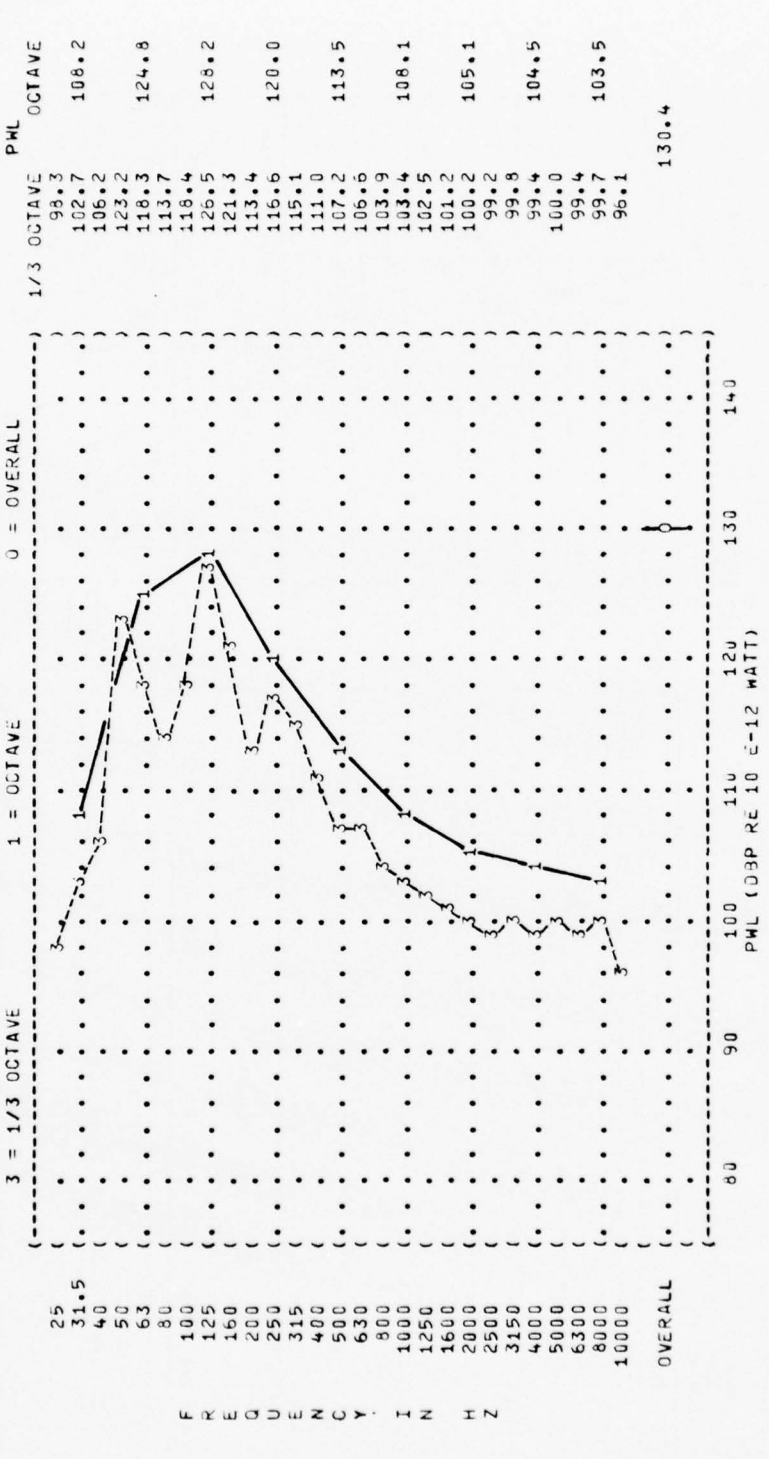


FIGURE: ACOUSTIC POWER LEVEL (PWL)

4

IDENTIFICATION:

OMEGA 1.4

TEST 75-002-050

RUN 02

30 MAY 75

PAGE 3

NOISE SOURCE/SUBJECT:

OPERATION:

MILITARY POWER

3400 RPM

GSO-480-A1A6/B1A6 ENGINE

BOTH ENGINES

FAR FIELD NOISE

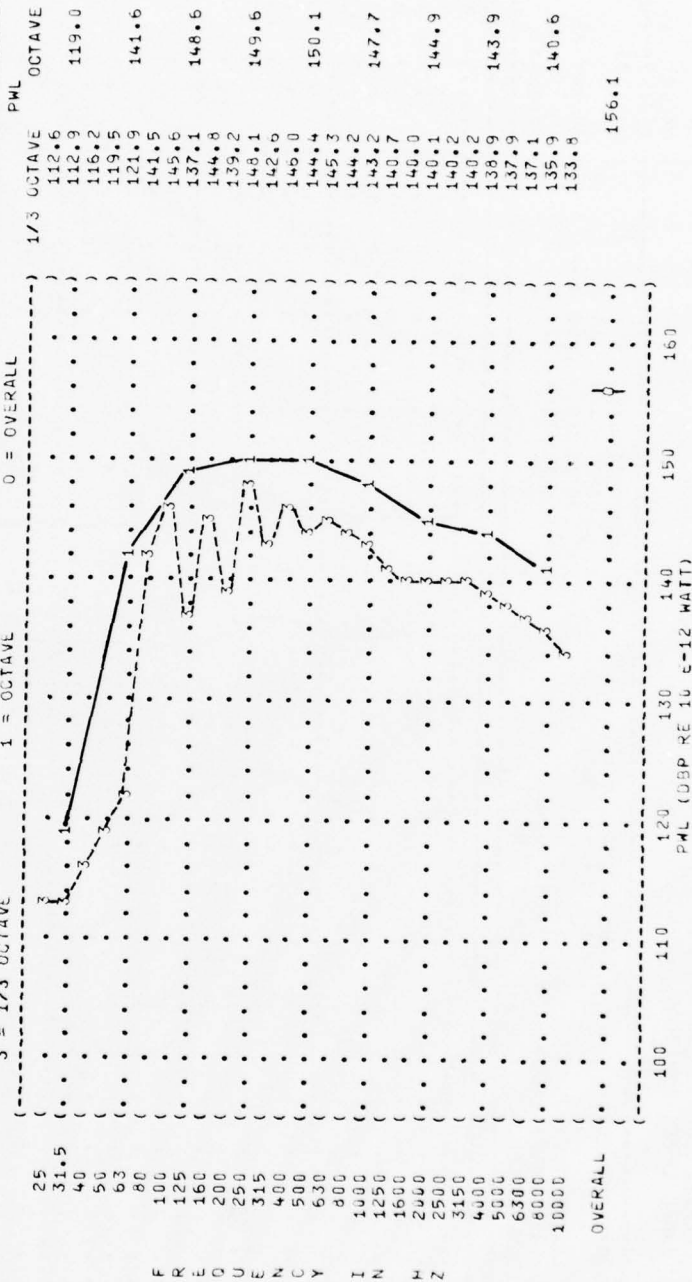
FREE FLOW

METEOROLOGY:

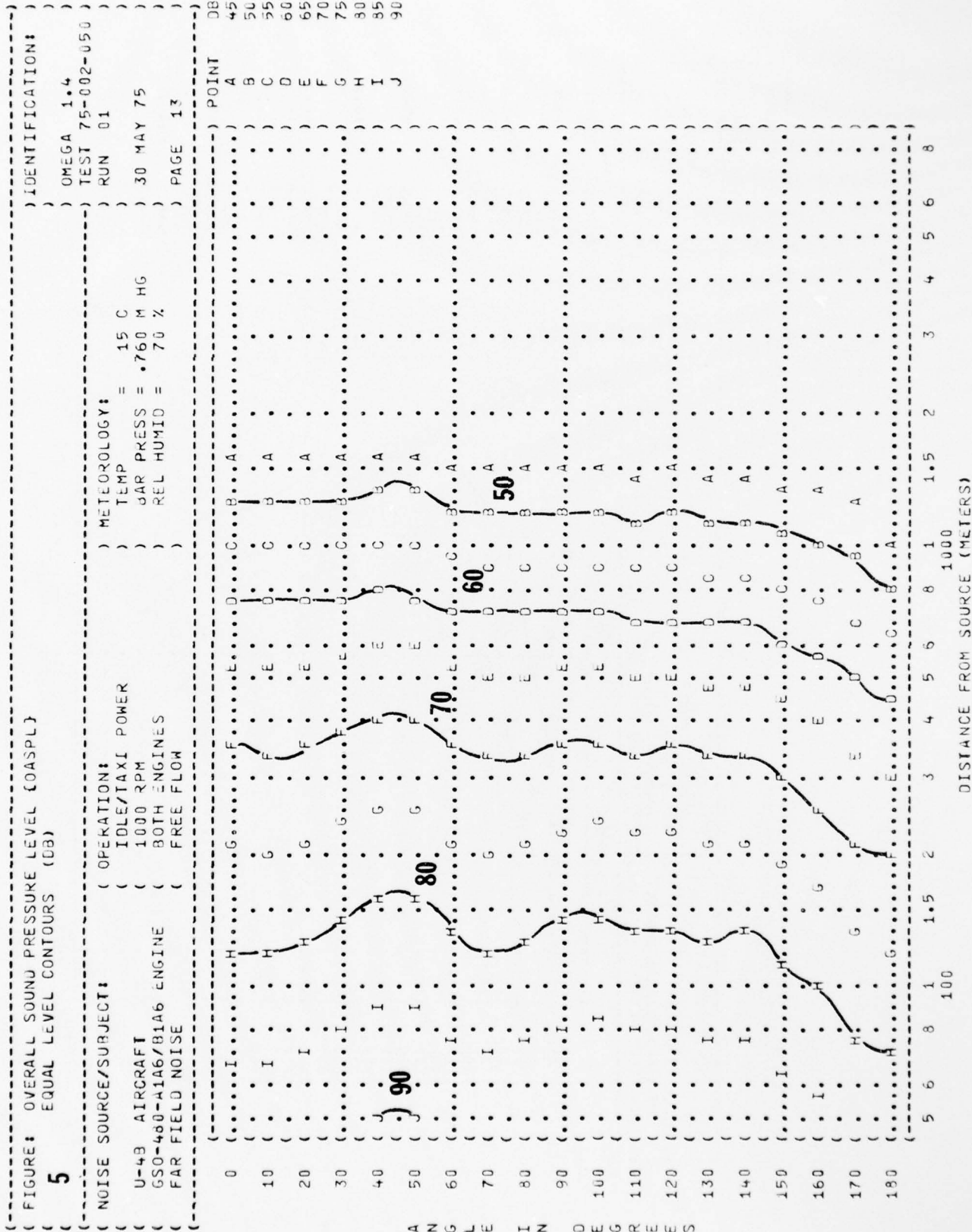
TEMP = 12 C

BAR PRESS = .766 M HG

REL HUMID = 50 %









IDENTIFICATION:

## METEOROLOGY:

TEOROLOGY:

TEMP = 15 C

BAR PRESS = .760 M HG

REL HUMID = 70 %

FREE FLOW

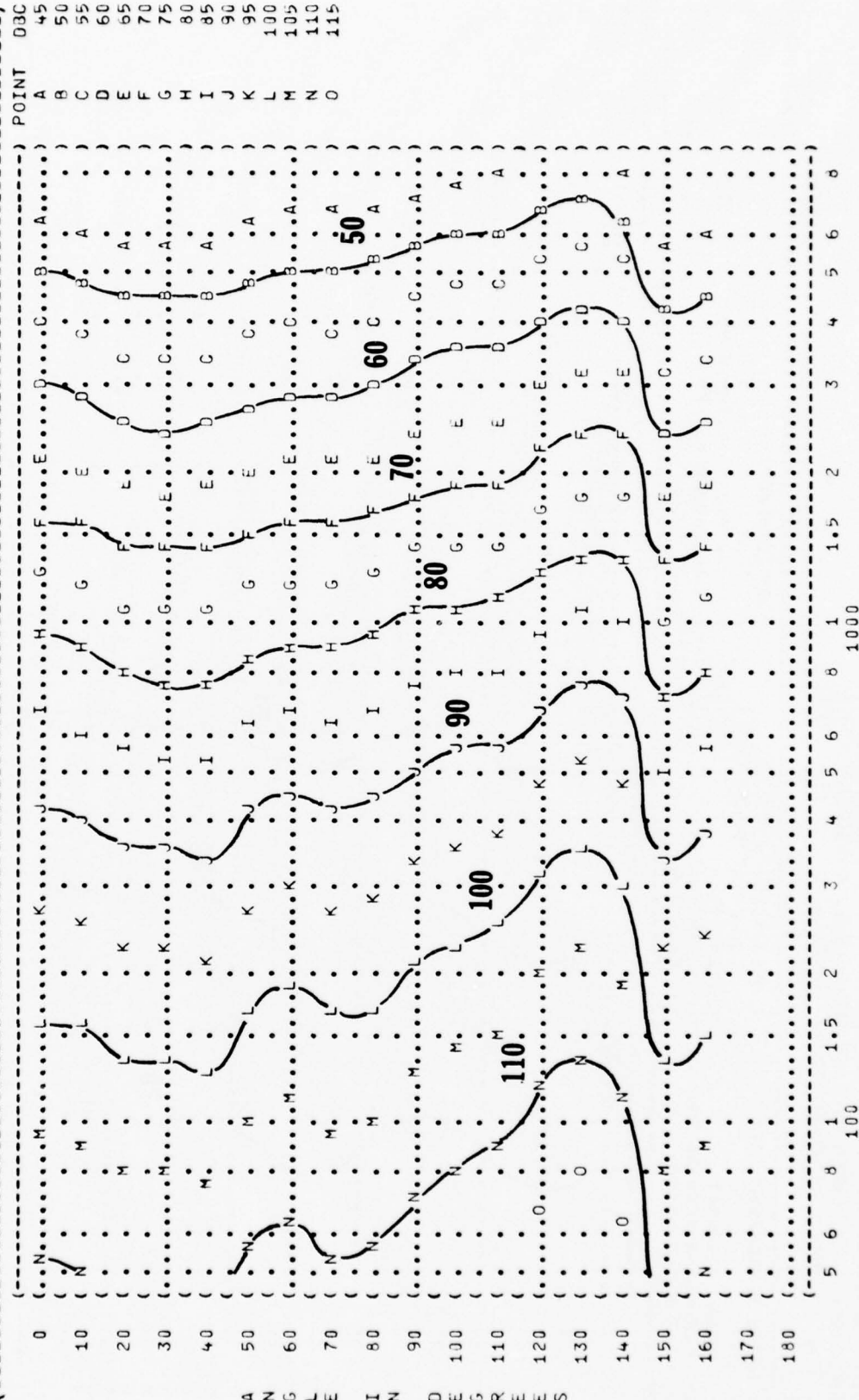
INT	DB
A	45
B	50
C	55
D	60
E	65
F	70
G	75
H	80
I	85
J	90
K	95
L	100
M	105
N	110
O	115



23



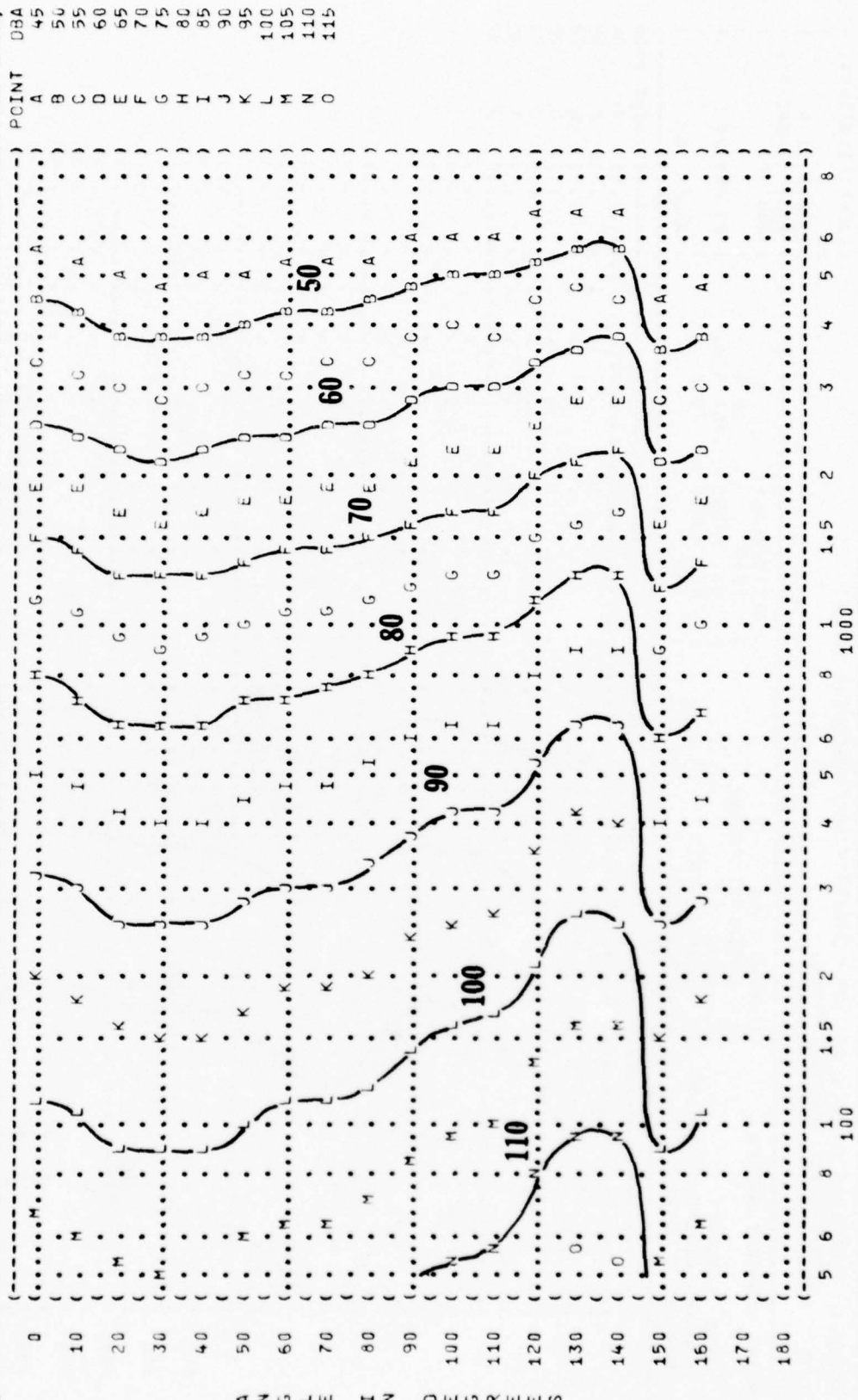
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(-----)
( FIGURE: C-WEIGHTED OVERALL SOUND LEVEL (OASLC) )
(      6      EQUAL LEVEL CONTOURS   (DBC) )
( )
(-----)
( NOISE SOURCE/SUBJECT: )
( U-4B AIRCRAFT )
( GSO-480-A1A6/B1A6 ENGINE )
( FAR FIELD NOISE )
( )
( OPERATION: )
( MILITARY POWER )
( 3400 RPM )
( BOTH ENGINES )
( FREE FLOW )
( )
( METEOROLOGY: )
( TEMP = 15 C )
( BAR PRESS = .760 M HG )
( REL HUMID = 70 % )
( )
( IDENTIFICATION: )
( OMEGA 1.4 )
( TEST 75-002-050 )
( RUN 02 )
( 30 MAY 75 )
( PAGE 14 )
(-----)
```







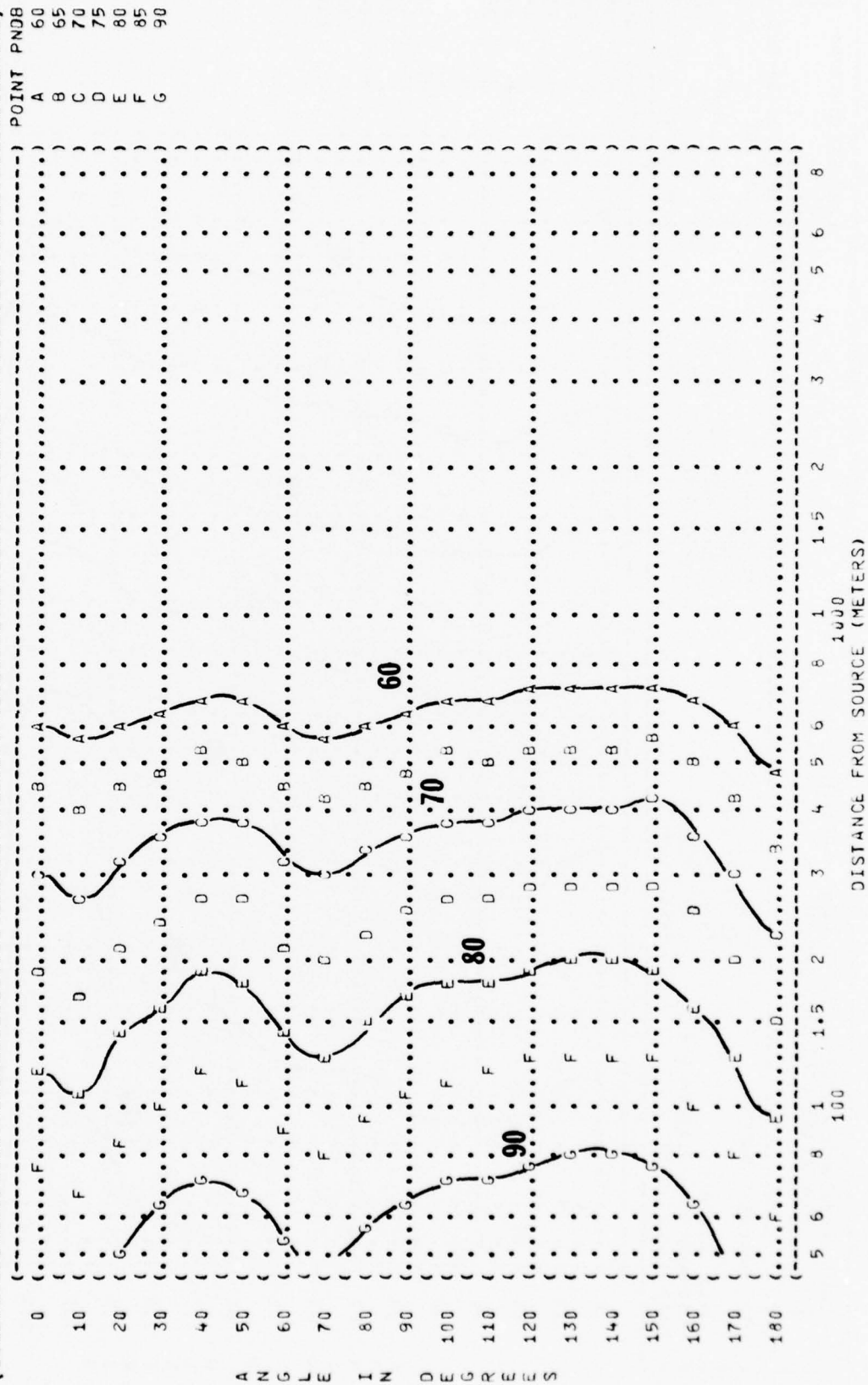
( FIGURE: A-WEIGHTED OVERALL SOUND LEVEL (OASLA)  
 ( 7 EQUAL LEVEL CONTOURS (DBA)  
 ( ) IDENTIFICATION:  
 ( ) OMEGA 1.4  
 ( ) TEST 75-002-050  
 ( ) RUN 02  
 ( NOISE SOURCE/SUBJECT: ) METEOROLOGY:  
 ( ) OPERATION: ) TEMP = 15 C  
 ( ) MILITARY POWER ) BAR PRESS = .760 M HG  
 ( ) U-48 AIRCRAFT ) 3400 RPM ) REL HUMID = 70 %  
 ( ) GSO-480-A1A6/B1A6 ENGINE ) 30 MAY 75  
 ( ) FAR FIELD NOISE ) FREE FLOW ) PAGE 15



A N G L E I N D E G R E E S



( FIGURE: PERCEIVED NOISE LEVEL WITH SMOOTH TONE CORRECTION (PNLT)  
 ( 8 EQUAL LEVEL CONTOURS (PNDB)  
 ( ) IDENTIFICATION:  
 ( ) OMEGA 1.4  
 ( ) TEST 75-002-050  
 ( ) RUN 01  
 ( ) METEOROLOGY:  
 ( ) TEMP = 15 C  
 ( ) BAR PRESS = .760 M HG  
 ( ) REL HUMID = 70 %  
 ( ) 30 MAY 75  
 ( ) PAGE 16  
 ( ) POINT PNDB  
 ( ) OPERATION:  
 ( ) IDLE/TAXI POWER  
 ( ) 1000 RPM  
 ( ) BOTH ENGINES  
 ( ) FREE FLOW  
 ( ) NOISE SOURCE/SUBJECT:  
 ( ) U-4B AIRCRAFT  
 ( ) GSO-480-A1A6/B1A6 ENGINE  
 ( ) FAR FIELD NOISE



PAGE 16

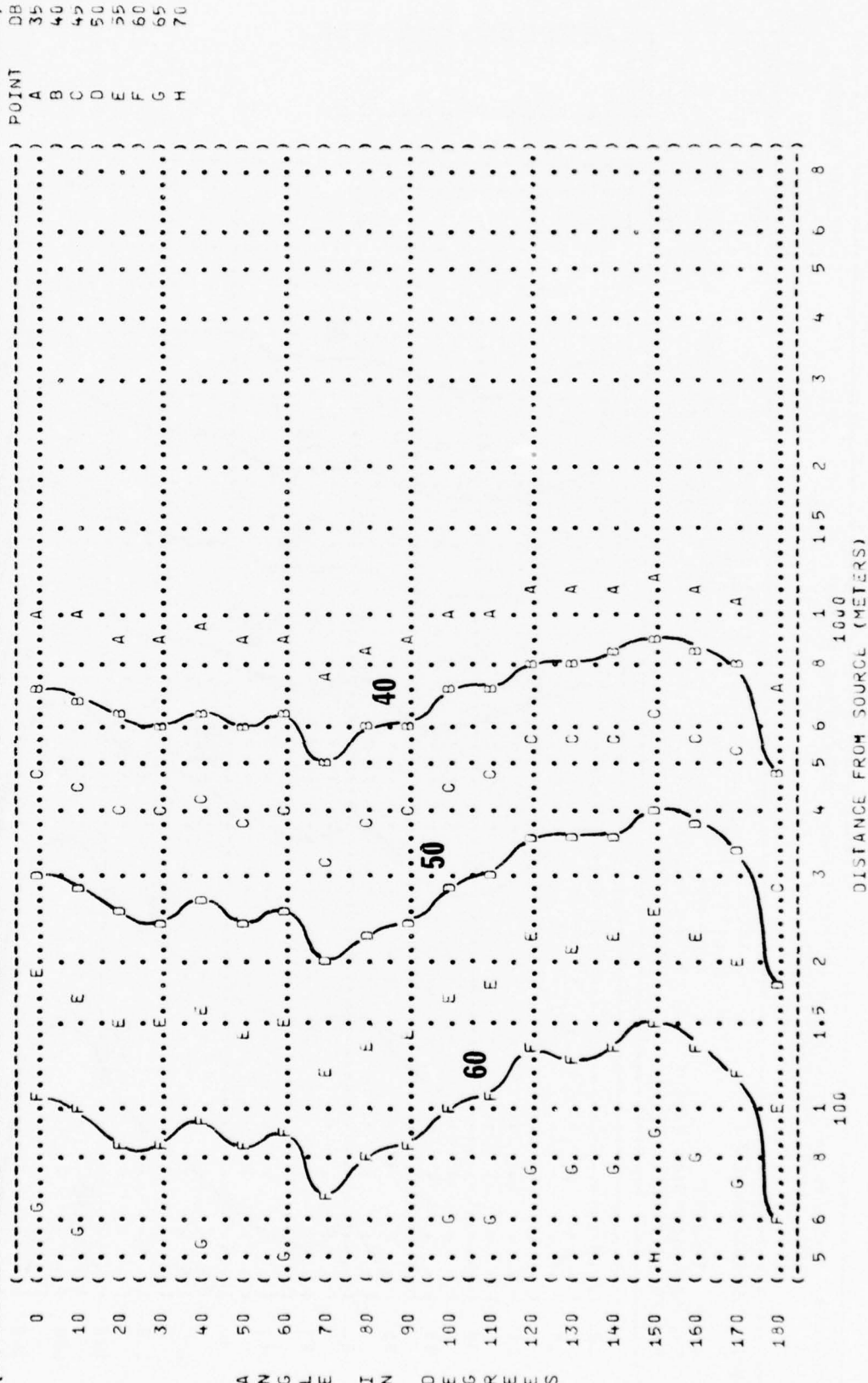
FLOW

FIELD NOISE ( FRE

( FAR F

DISTANCE FROM SOURCE (METERS)

( ( FIGURE: PREFERRED SPEECH INTERFERENCE LEVEL (PSIL)  
 ( ( 9  
 ( ( EQUAL LEVEL CONTOURS (DB)  
 ( ( NOISE SOURCE/SUBJECT: ( OPERATION: ( METEOROLOGY: ( IDENTIFICATION:  
 ( ( U-48 AIRCRAFT ( IDLE/TAXI POWER ( TEMP = 15 C ( OMEGA 1.4  
 ( ( GSO-480-A1A6/B1A6 ENGINE ( 1000 RPM ( BAR PRESS = .760 M HG ( TEST 75-002-050  
 ( ( FAR FIELD NOISE ( BOTH ENGINES ( REL HUMID = 70 % ( RUN 01  
 ( ( ( FREE FLOW ( ) 30 MAY 75  
 ( ( ) PAGE 17  
 ( ( )



```
IDENTIFICATION:
OMEGA 1.4
TEST 75-002-050
RUN 02
30 MAY 75
PAGE 17
```

METEOROLOGY:

TEMP = 15 C

BAR PRESS = .760 M HG

REL HUMID = 70 %

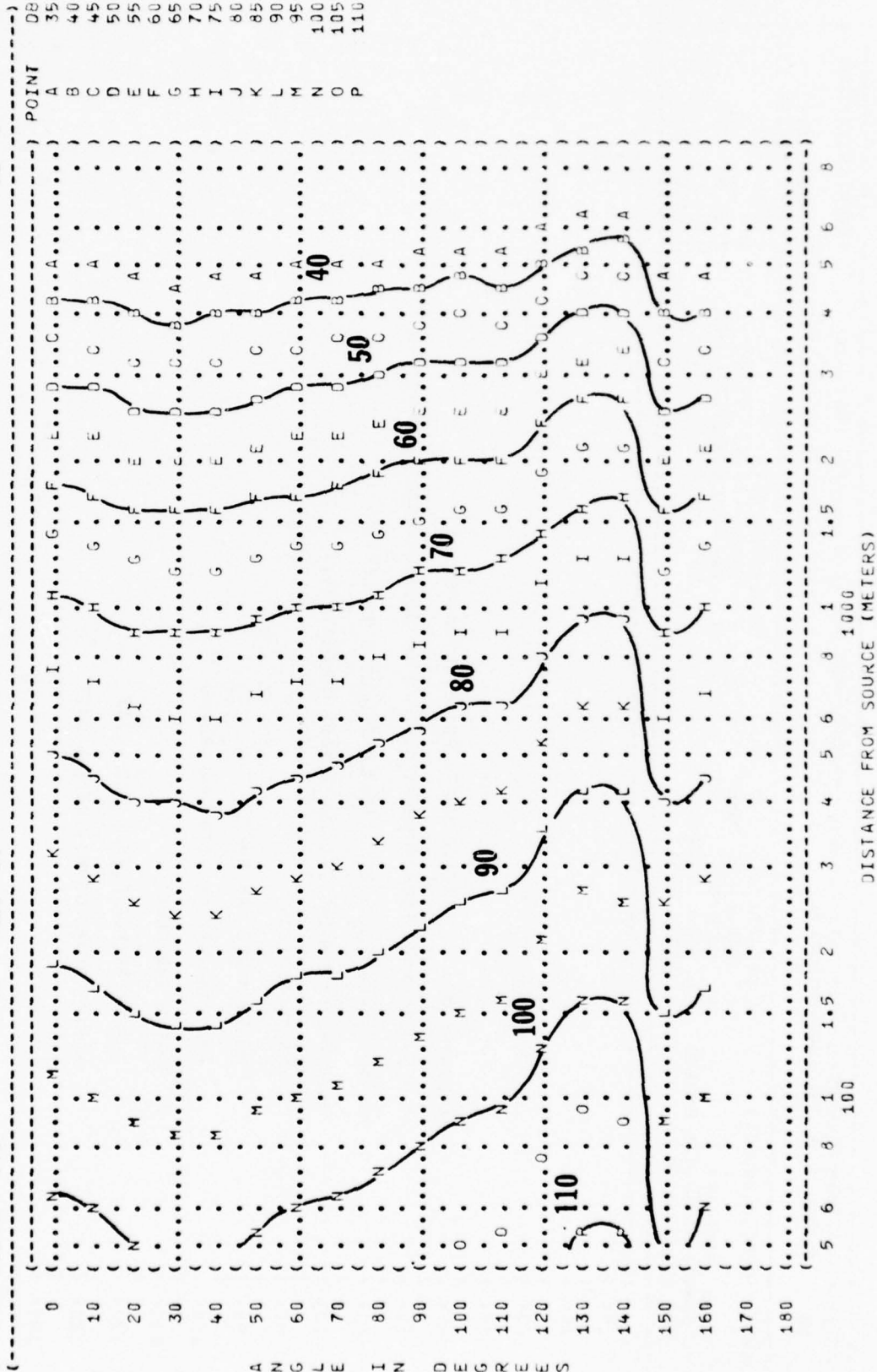
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REFERENCE LEVEL (PSIL)
(DB)

-----
( OPERATION:
( MILITARY POWER
( 3400 RPM
( BOTH ENGINES
( FREE FLOW

```

( ( FIGURE: PREFERRED SPEECH INT  
( ( 9  
( ( EQUAL LEVEL CONTOURS  
( ( -----  
( ( NOISE SOURCE/SUBJECT:  
( ( U-49 AIRCRAFT  
( ( GSO-480-A1A6/B1A6 ENGINE  
( ( FAR FIELD NOISE

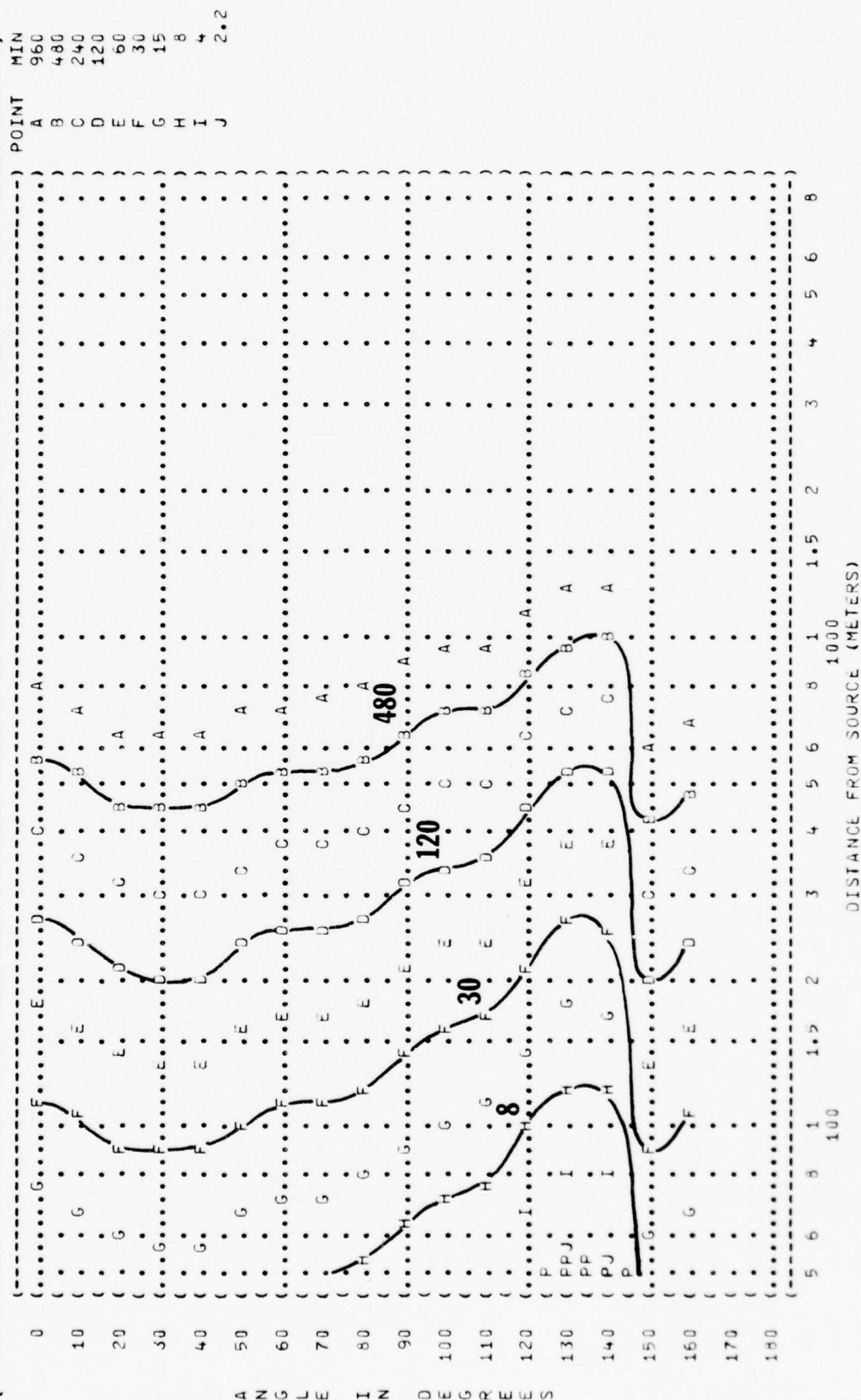






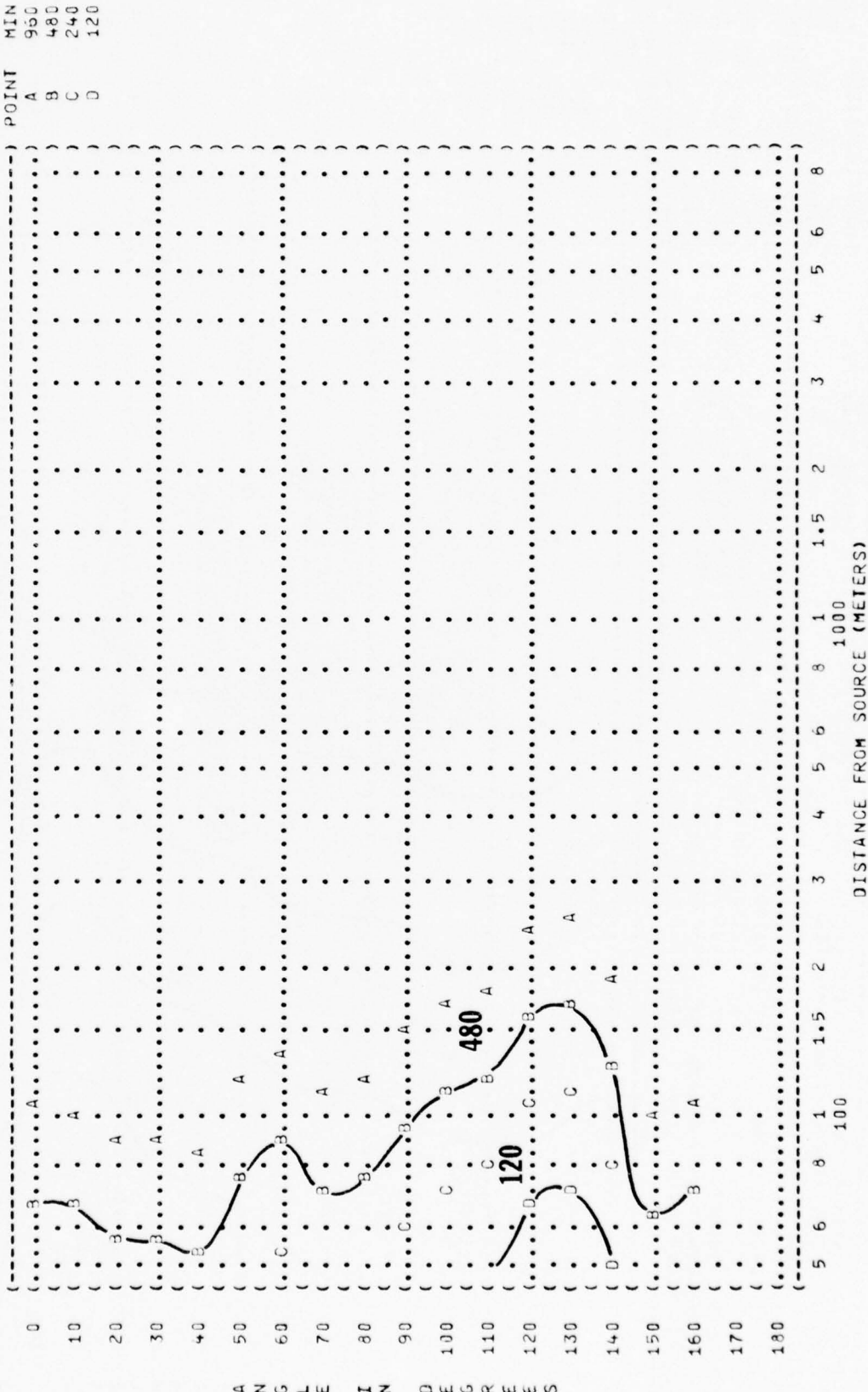


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(-----)
( ) FIGURE: MAXIMUM PERMISSIBLE TIME (T) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)
( ) IDENTIFICATION:
( ) 10 EQUAL TIME CONTOURS (MINUTES)
( ) NO PROTECTION
(-----)
( ) NOISE SOURCE/SUBJECT: ( OPERATION: ) METEOROLOGY:
( ) ( MILITARY POWER ) TEMP = 15 C
( ) U-4B AIRCRAFT ( 3400 RPM ) BAR PRESS = .700 M HG
( ) GSO-400-A1A6/B1A6 ENGINE ( BOTH ENGINES ) REL HUMID = 73 %
( ) FAR FIELD NOISE ( FREE FLOW ) PAGE 7
(-----)
```



ADDITIONAL EAR PROTECTION REQUIRED.

( ( FIGURE: MAXIMUM PERMISSIBLE TIME (T) FOR ONE EXPOSURE PER DAY (AFK 161-35, JULY 73) ) IDENTIFICATION: )  
 ( ( 10 EQUAL TIME CONTOURS (MINUTES) ) )  
 ( ( MINIMUM QPL EAR MUFFS ) )  
 ( ( NOISE SOURCE/SUBJECT: ) OPERATION: ) METEOROLOGY: )  
 ( ( U-48 AIRCRAFT ) ) MILITARY POWER )  
 ( ( GSO-480-A1A6/B1A6 ENGINE ) ) 3400 RPM )  
 ( ( FAR FIELD NOISE ) ) BOTH ENGINES )  
 ( ( ) ) REL HUMID = 70 % )  
 ( ( ) ) PAGE 8 )  
 ( ( ) ) TEST 75-002-050 )  
 ( ( ) ) RUN 02 )  
 ( ( ) ) OMEGA 1.4 )



A N G L E I N D E G R E E S

[illegible][illegible]

35





FIGURE: MAXIMUM PERMISSIBLE TIME (T) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)

IDENTIFICATION:

10

EQUAL TIME CONTOURS (MINUTES)

COMFIT TRIPLE FLANGE EAR PLUGS

NOISE SOURCE/SUBJECT:

OPERATION:

MILITARY POWER

U-48 AIRCRAFT

3400 RPM

GSO-480-A1A6/B1A6 ENGINE

BOTH ENGINES

FAR FIELD NOISE

FREE FLOW

METEOROLOGY:

TEMP = 15 C

BAR PRESS = .760 M HG

REL HUMID = 70 %

OMEGA 1.4

TEST 75-002-050

RUN 02

30 MAY 75

PAGE 11

POINT

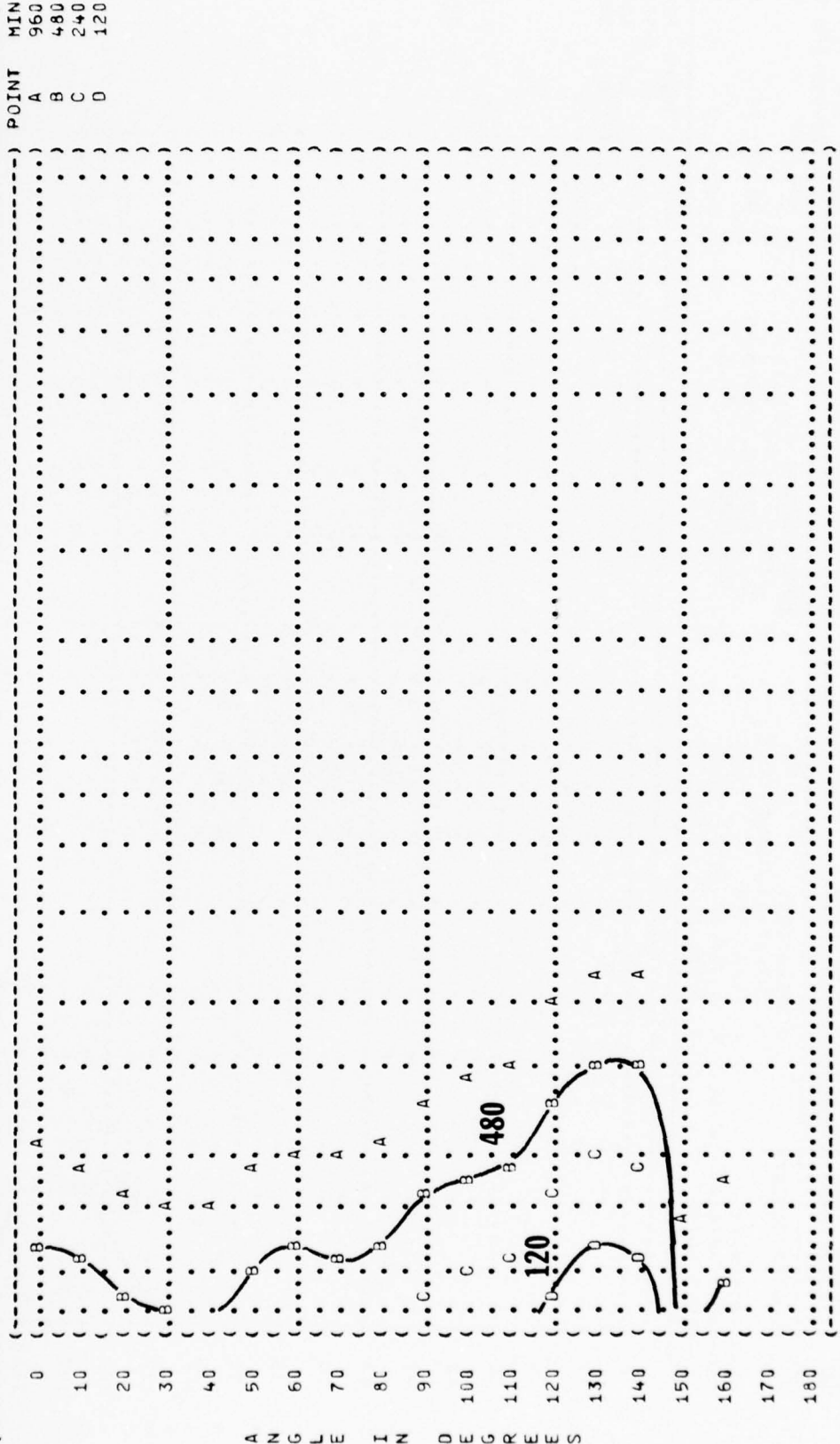
MIN

A 960

B 480

C 240

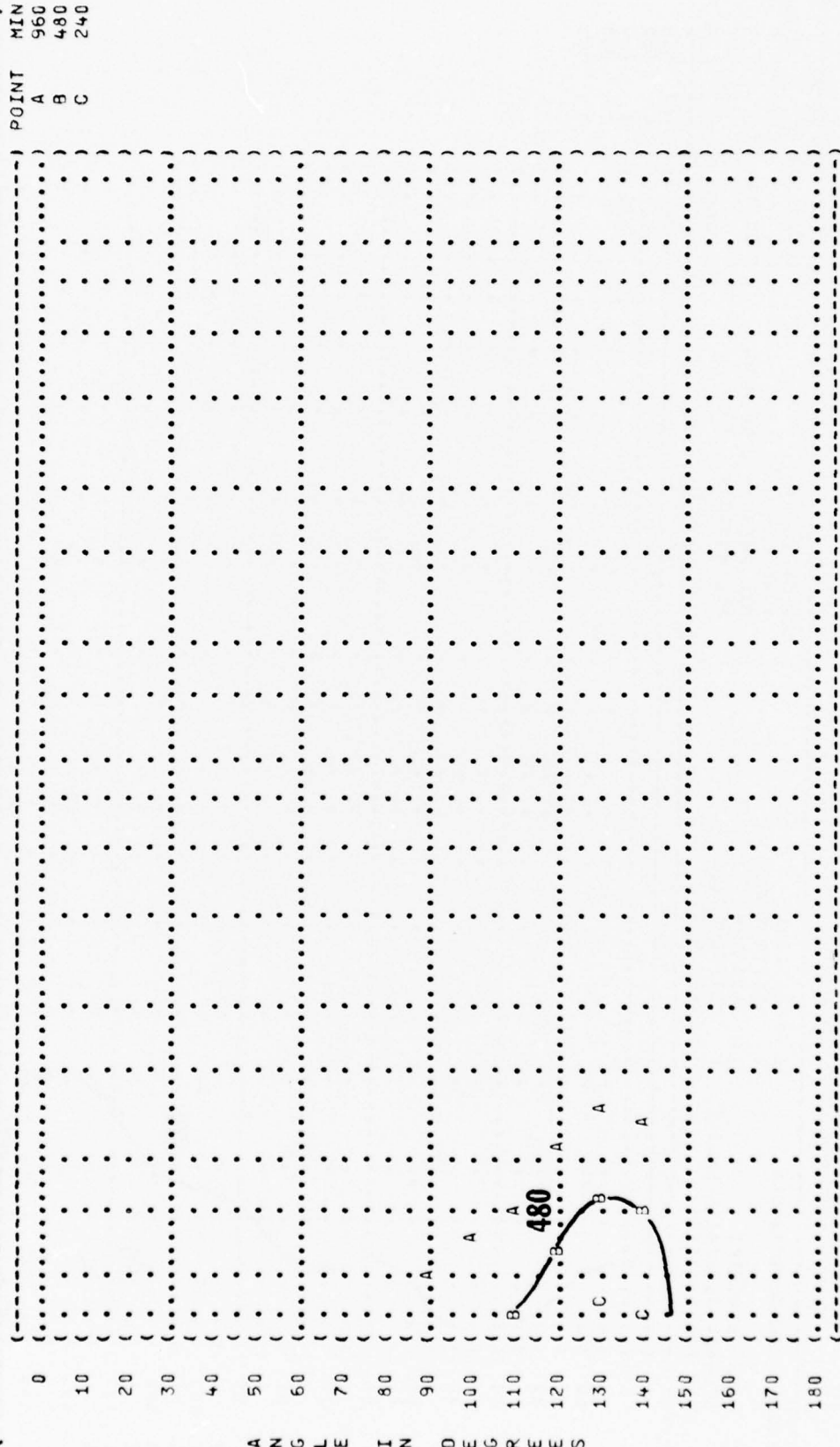
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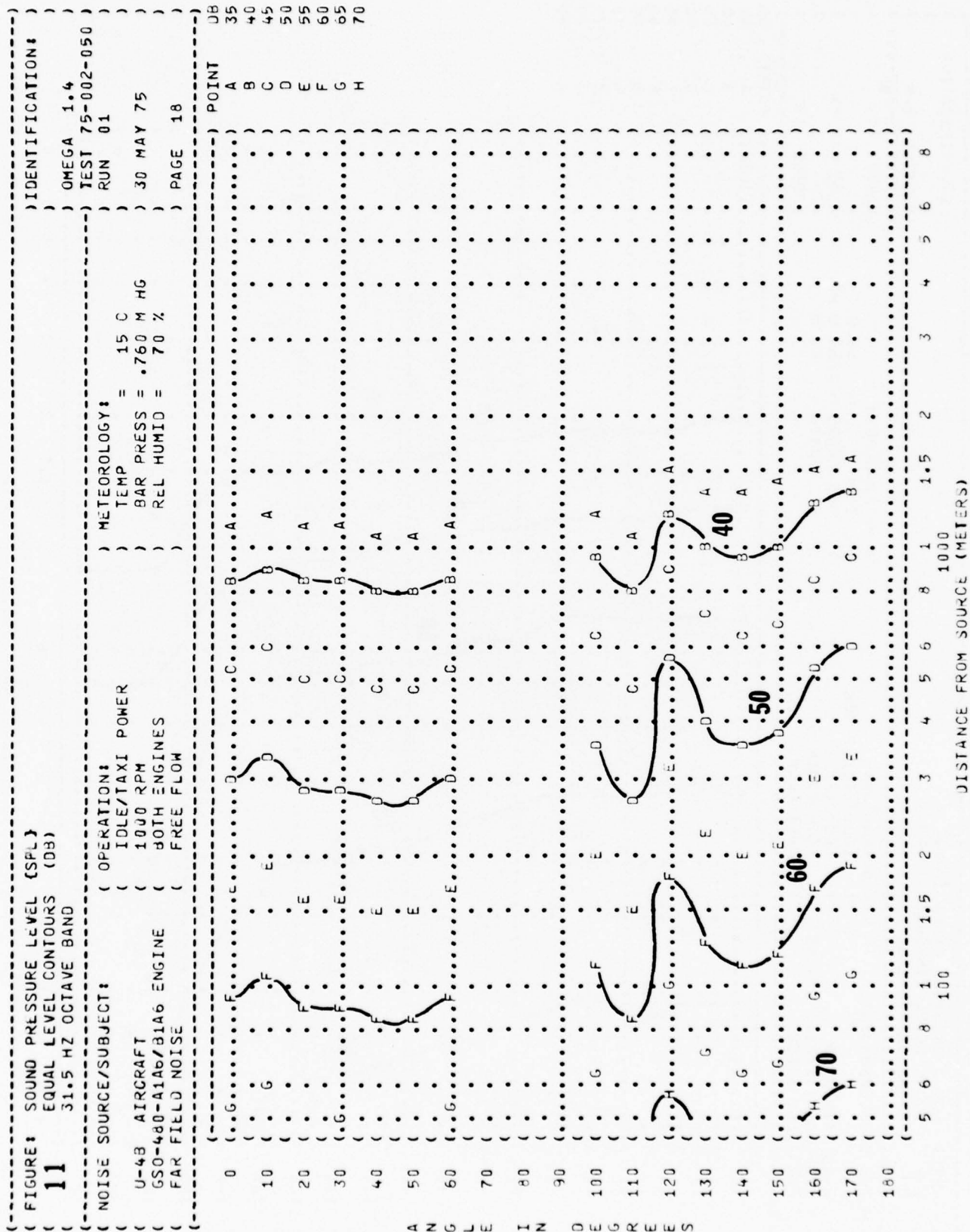
DISTANCE FROM SOURCE (METERS)



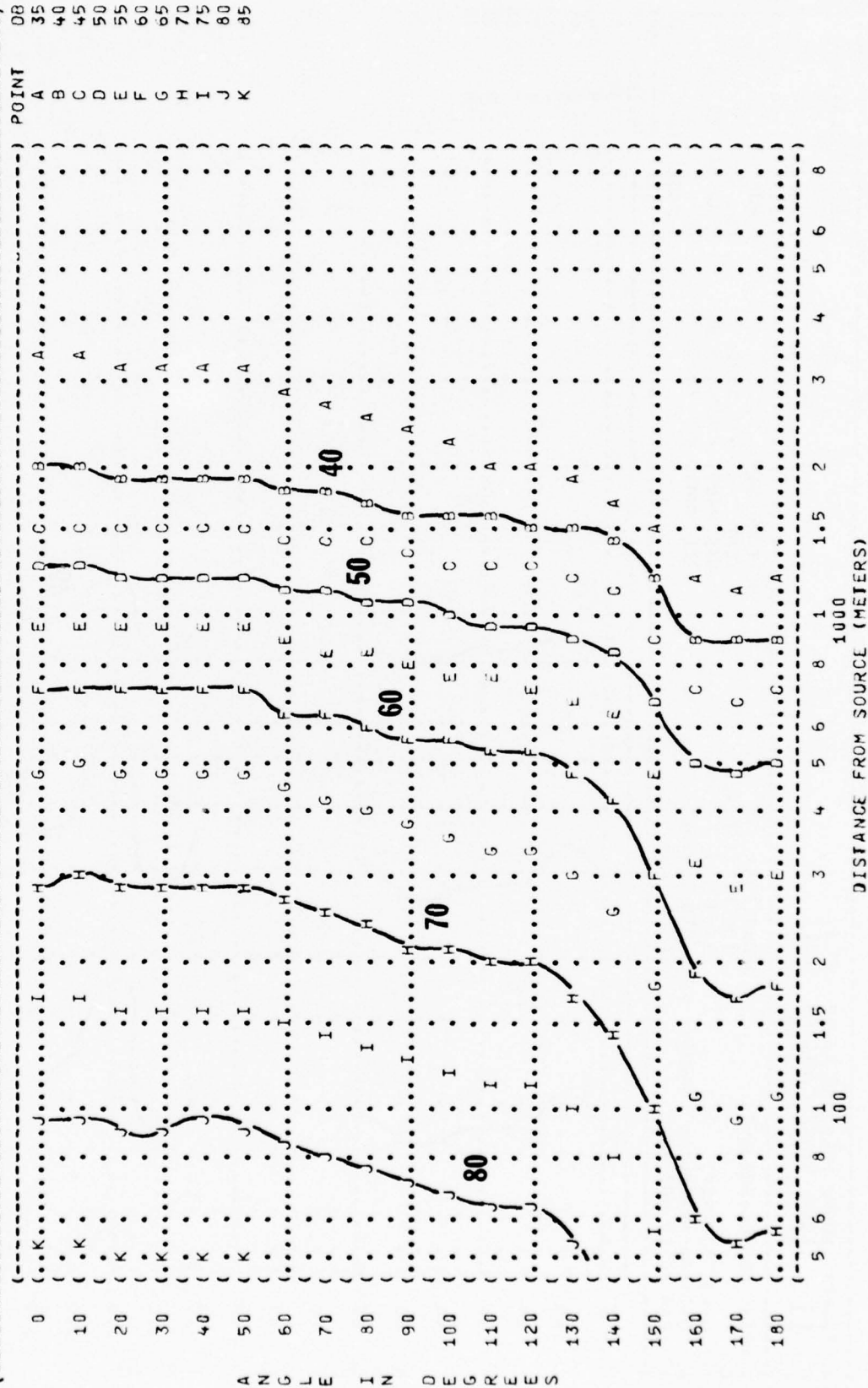
( ( FIGURE: MAXIMUM PERMISSIBLE TIME (T) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73) ) IDENTIFICATION: )  
 ( ( 10 EQUAL TIME CONTOURS (MINUTES) ) )  
 ( ( H-133 GROUND COMMUNICATION UNIT ) )  
 ( ( NOISE SOURCE/SUBJECT: ) )  
 ( ( ( OPERATION: ) )  
 ( ( ( MILITARY POWER ) )  
 ( ( ( 3400 RPM ) )  
 ( ( ( U-48 AIRCRAFT ) )  
 ( ( ( GSO-480-A1A6/B1A6 ENGINE ) )  
 ( ( ( FAR FIELD NOISE ) )  
 ( ( ( METEOROLOGY: ) )  
 ( ( ( TEMP = 15 C ) )  
 ( ( ( BAR PRESS = .760 M HG ) )  
 ( ( ( REL HUMID = 70 % ) )  
 ( ( ( RUN 02 ) )  
 ( ( ( TEST 75-002-050 ) )  
 ( ( ( OMEGA 1.4 ) )  
 ( ( ( PAGE 12 ) )  
 ( ( ( POINT MIN ) )  
 ( ( ( A 960 ) )  
 ( ( ( B 480 ) )  
 ( ( ( C 240 ) )



( ( 5 6 8 1 1.5 2 3 4 5 6 8 ) )  
 ( ( 100 1000 ) )  
 ( ( DISTANCE FROM SOURCE (METERS) ) )



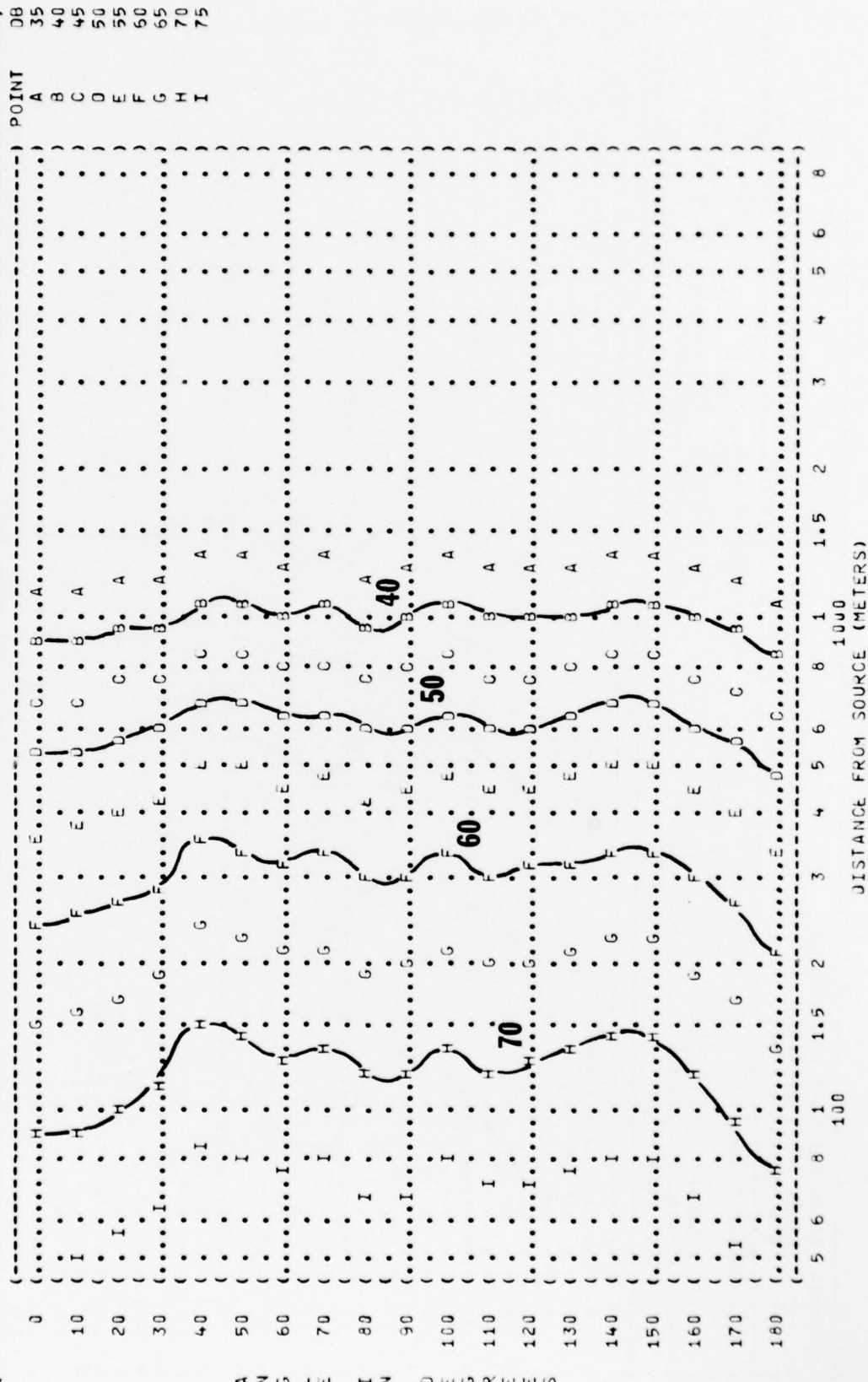
( FIGURE: SOUND PRESSURE LEVEL (SPL)  
 ( 11 EQUAL LEVEL CONTOURS (DB)  
 ( 63 HZ OCTAVE BAND  
 ( NOISE SOURCE/SUBJECT:  
 ( U-4B AIRCRAFT  
 ( GSO-480-A1A6/B1A6 ENGINE  
 ( FAR FIELD NOISE  
 ( OPERATION:  
 ( IDLE/TAXI POWER  
 ( 1000 RPM  
 ( BOTH ENGINES  
 ( FREE FLOW  
 ( METEOROLOGY:  
 ( TEMP = 15 C  
 ( BAR PRESS = .760 M HG  
 ( REL HUMID = 70 %  
 ( IDENTIFICATION:  
 ( OMEGA 1.4  
 ( TEST 75-002-050  
 ( RUN 01  
 ( 30 MAY 75  
 ( PAGE 19





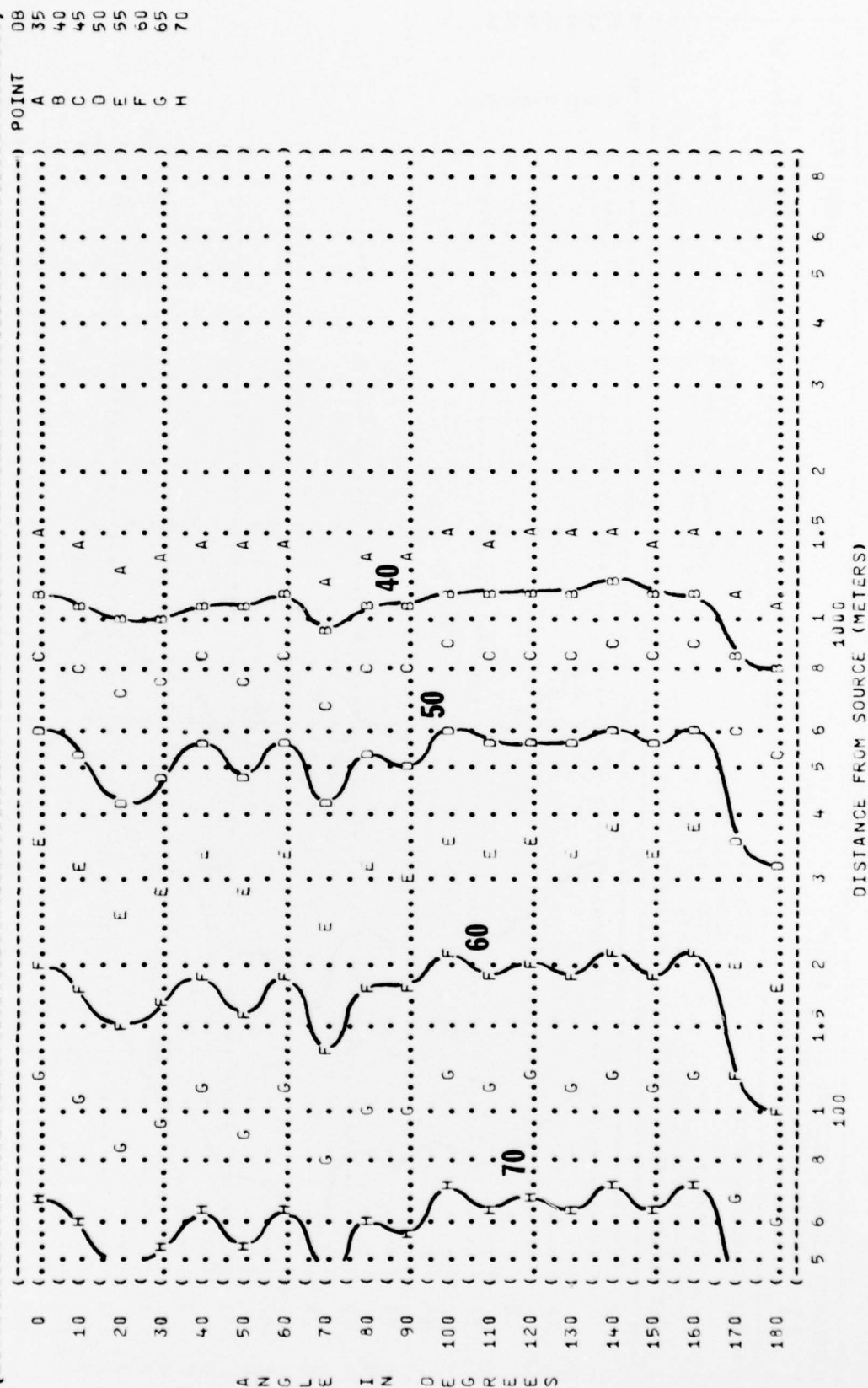


( FIGURE: SOUND PRESSURE LEVEL (SPL)  
 ( EQUAL LEVEL CONTOURS (DB)  
 ( 250 HZ OCTAVE BAND  
 ( 11  
 ( NOISE SOURCE/SUBJECT: ( OPERATION: ( IDENTITY: ( IDENTIFICATION: ( )  
 ( U-48 AIRCRAFT ( IDLE/TAXI POWER ( ) OMEGA 1.4  
 ( GSO-480-A146/B146 ENGINE ( 1000 RPM ( ) TEST 75-002-050  
 ( FAR FIELD NOISE ( BOTH ENGINES ( ) RUN 01  
 ( FREE FLOW ( ) 30 MAY 75  
 ( ) REL HUMID = 70 %  
 ( ) PAGE 21  
 ( )





( FIGURE: SOUND PRESSURE LEVEL (SPL) )  
 ( 11 EQUAL LEVEL CONTOURS (DB) )  
 ( 500 HZ OCTAVE BAND )  
 ( NOISE SOURCE/SUBJECT: )  
 ( OPERATION: )  
 ( IDLE/TAXI POWER )  
 ( 1000 RPM )  
 ( GSO-480-A1A6/B1A6 ENGINE )  
 ( FAR FIELD NOISE )  
 ( METEOROLOGY: )  
 ( TEMP = 15 C )  
 ( BAR PRESS = .760 M HG )  
 ( REL HUMID = 70 % )  
 ( IDENTIFICATION: )  
 ( OMEGA 1.4 )  
 ( TEST 75-002-050 )  
 ( RUN 01 )  
 ( 30 MAY 75 )  
 ( PAGE 22 )



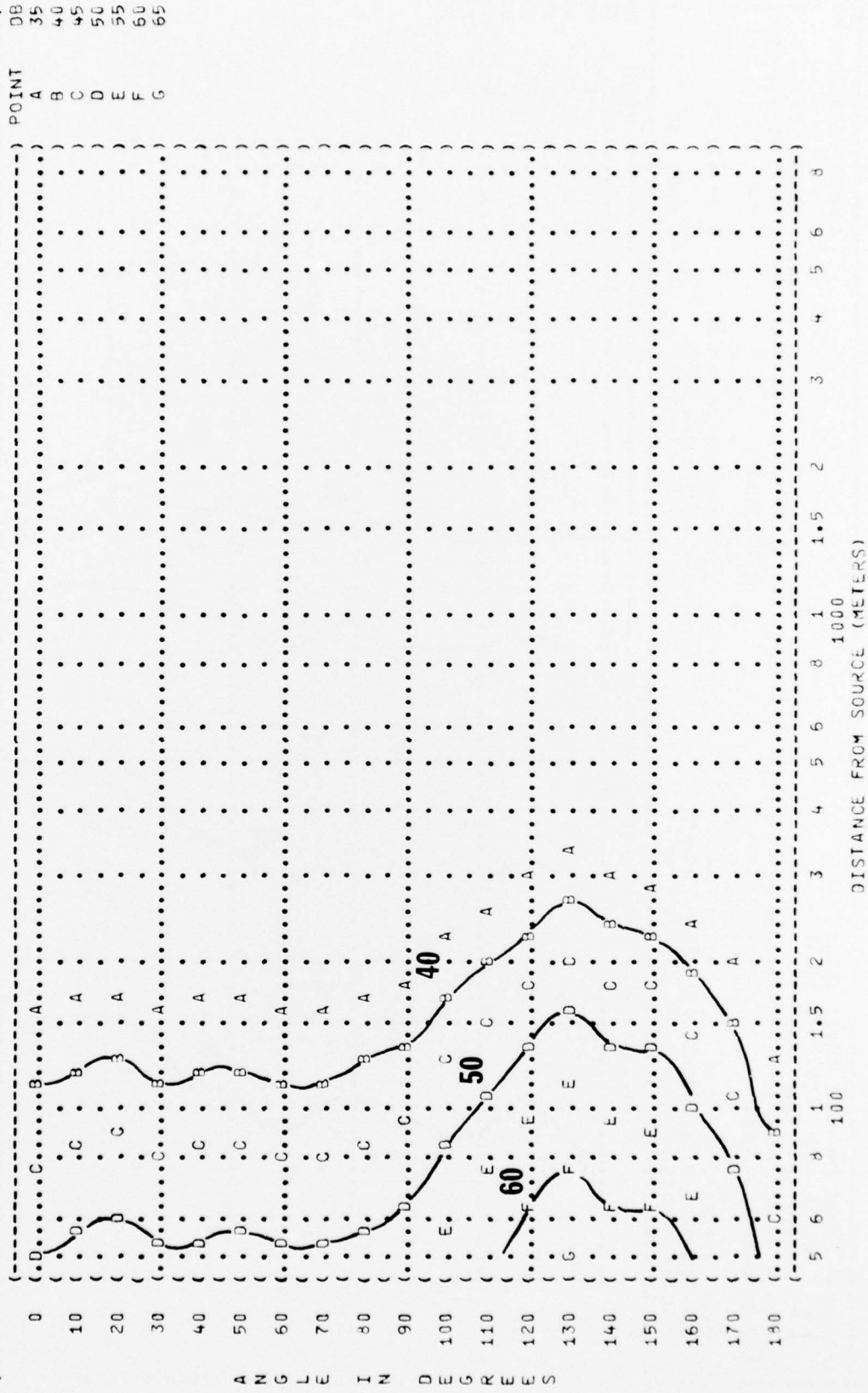


The figure is a 3D wireframe plot of a function. The vertical axis is labeled 'POINT' and ranges from 0 to 180. The horizontal axes are labeled 'D' and 'D2', both ranging from 0 to 6. The plot shows a surface with several peaks and valleys. The surface is defined by a series of connected points forming a continuous line. The plot includes labels 40, 50, and 60, which likely represent specific points or levels on the surface. The surface starts at a low point near (0,0) and rises to a peak near (6,6), with several smaller peaks and valleys in between.



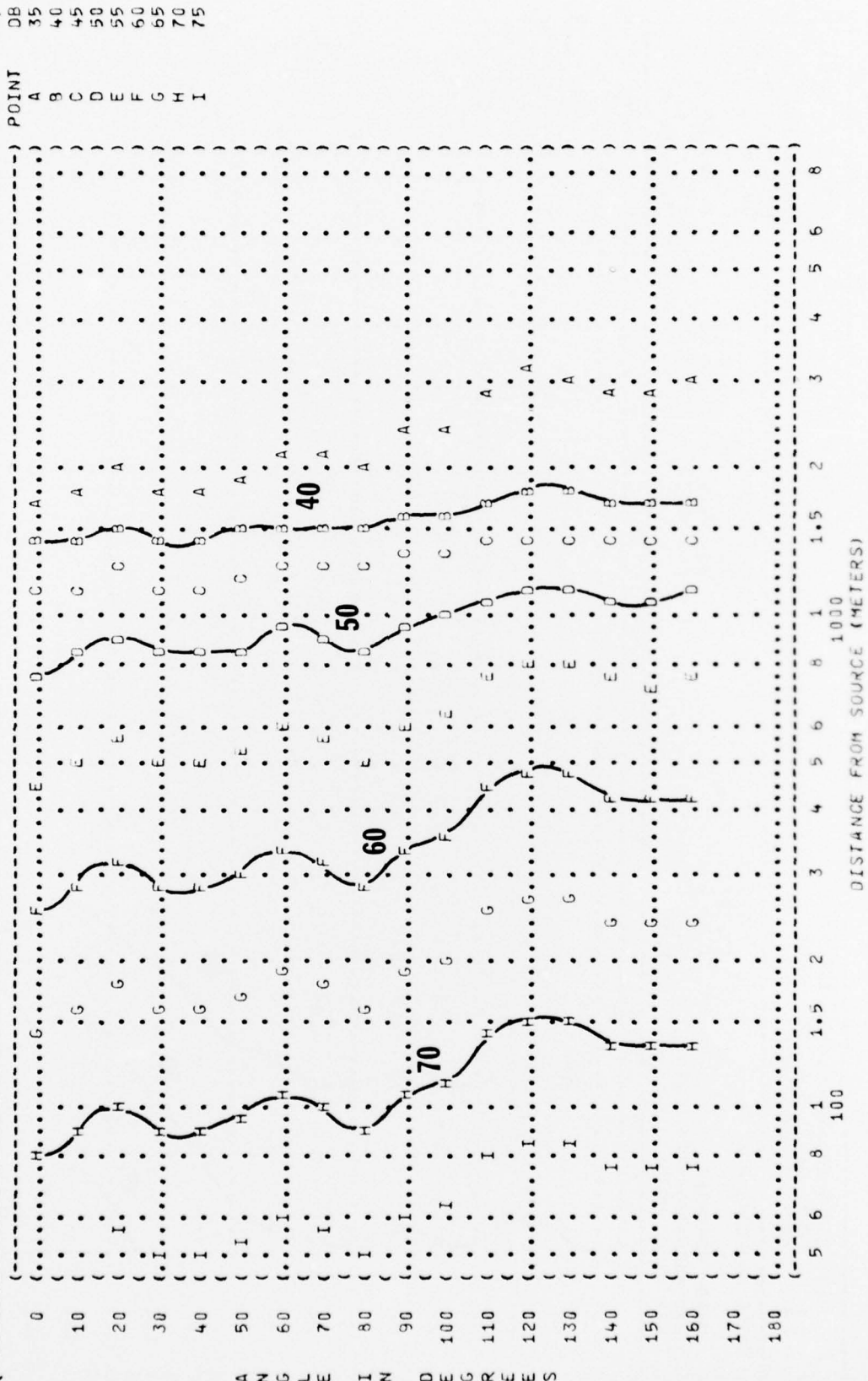


( FIGURE: SOUND PRESSURE LEVEL (SPL) )  
 ( 11 EQUAL LEVEL CONTOURS (DB) )  
 ( 8000 HZ OCTAVE BAND )  
 ( NOISE SOURCE/SUBJECT: )  
 ( U-4B AIRCRAFT )  
 ( GSO-480-A1A6/B1A6 ENGINE )  
 ( FAR FIELD NOISE )  
 ( OPERATION: )  
 ( IDLE/TAXI POWER )  
 ( 1000 RPM )  
 ( BOTH ENGINES )  
 ( FREE FLOW )  
 ( METEOROLOGY: )  
 ( TEMP = 15 C )  
 ( BAK PRESS = .760 M HG )  
 ( REL HUMID = 70 % )  
 ( IDENTIFICATION: )  
 ( OMEGA 1.4 )  
 ( TEST 75-002-050 )  
 ( RUN 01 )  
 ( 30 MAY 75 )  
 ( PAGE 26 )



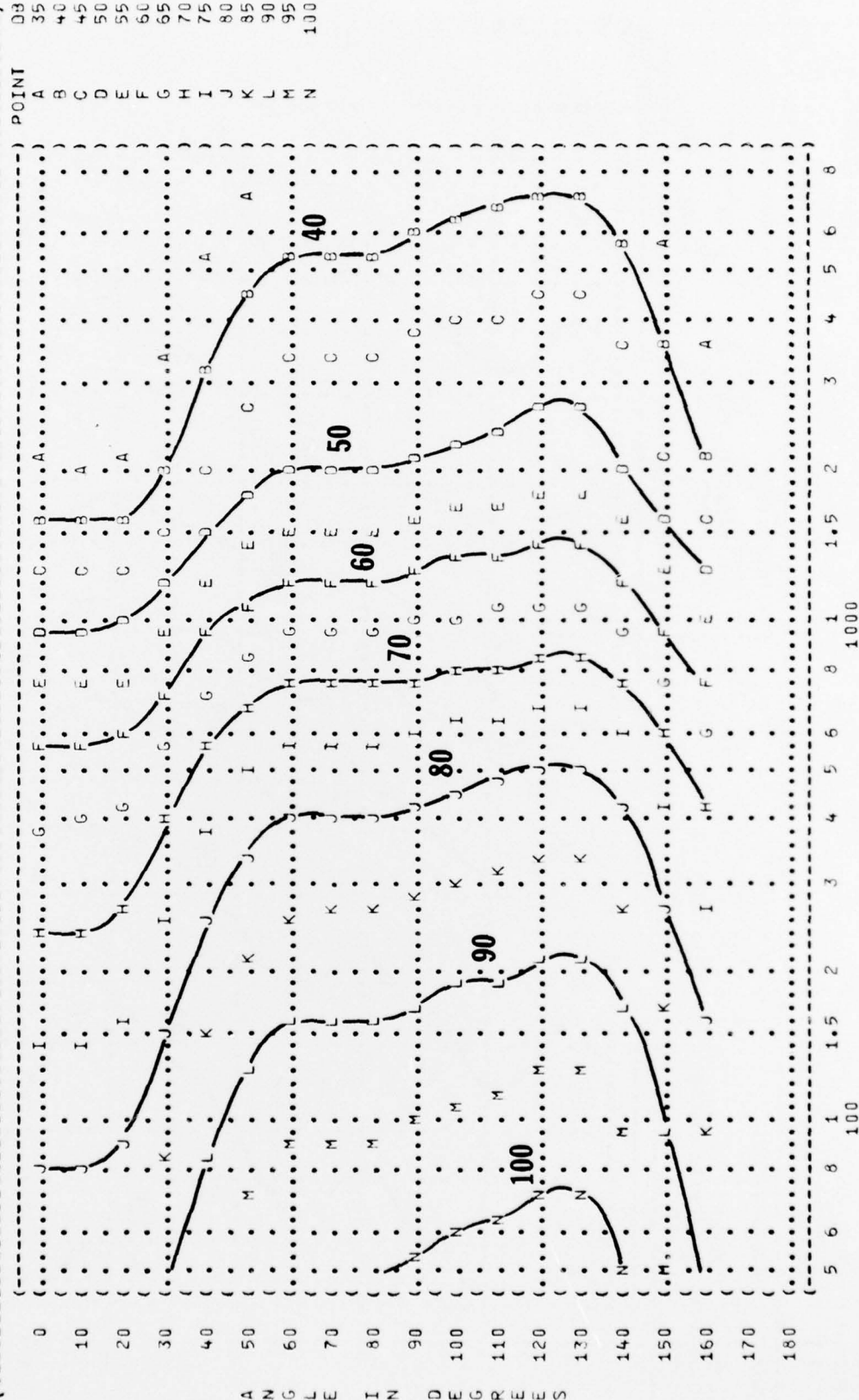


( FIGURE: SOUND PRESSURE LEVEL (SPL) )  
 ( 11 )  
 ( 31.5 HZ OCTAVE BAND )  
 ( NOISE SOURCE/SUBJECT: )  
 ( U-48 AIRCRAFT )  
 ( GSO-480-A1A6/B1A6 ENGINE )  
 ( FAR FIELD NOISE )  
 ( OPERATION: )  
 ( MILITARY POWER )  
 ( 3400 RPM )  
 ( BOTH ENGINES )  
 ( FREE FLOW )  
 ( METEOROLOGY: )  
 ( TEMP = 15 C )  
 ( BAR PRESS = .760 M HG )  
 ( REL HUMID = 70 % )  
 ( IDENTIFICATION: )  
 ( OMEGA 1.4 )  
 ( TEST 75-002-050 )  
 ( RUN 02 )  
 ( 30 MAY 75 )  
 ( PAGE 18 )

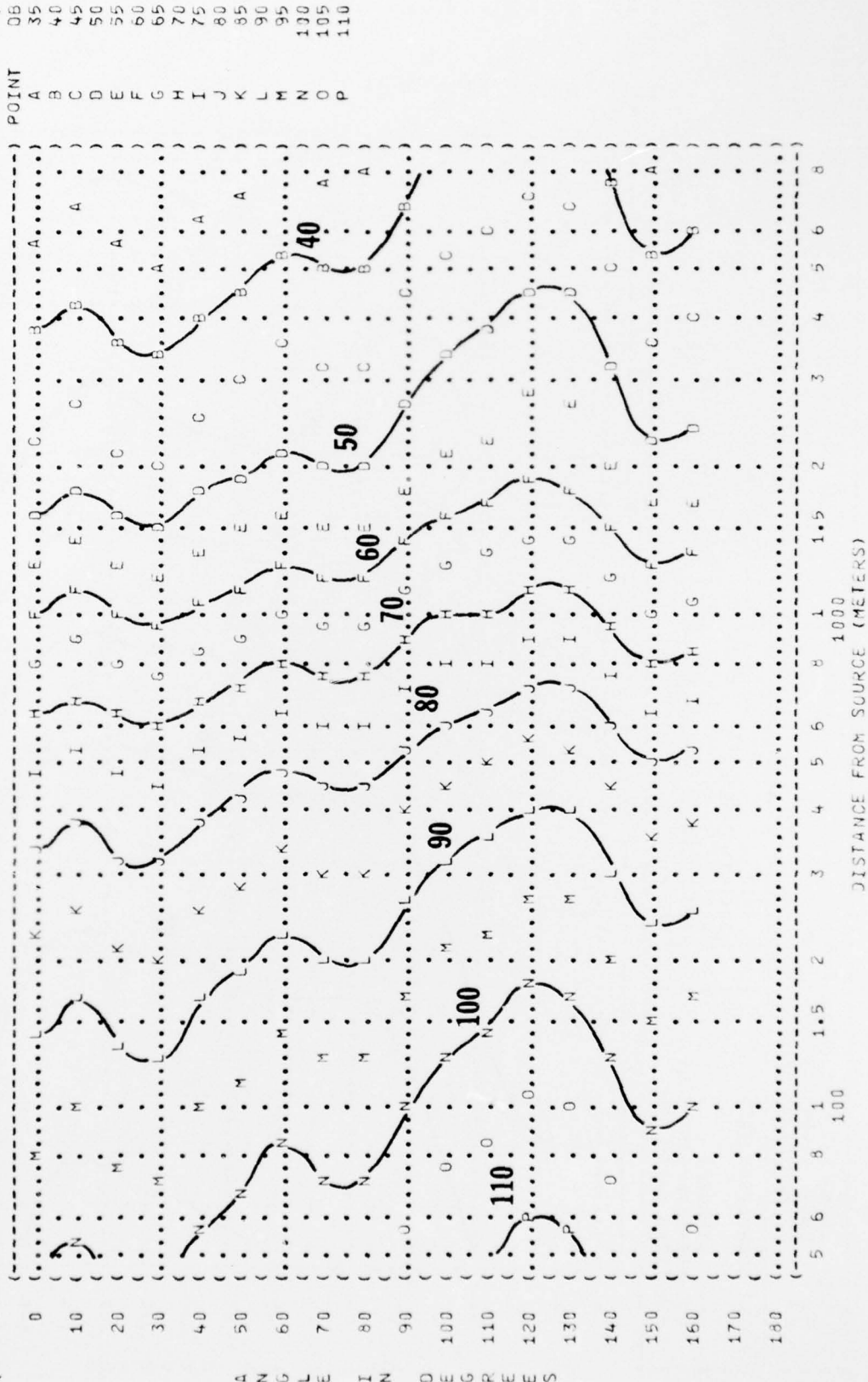


A N G L E I N D E G R E E S

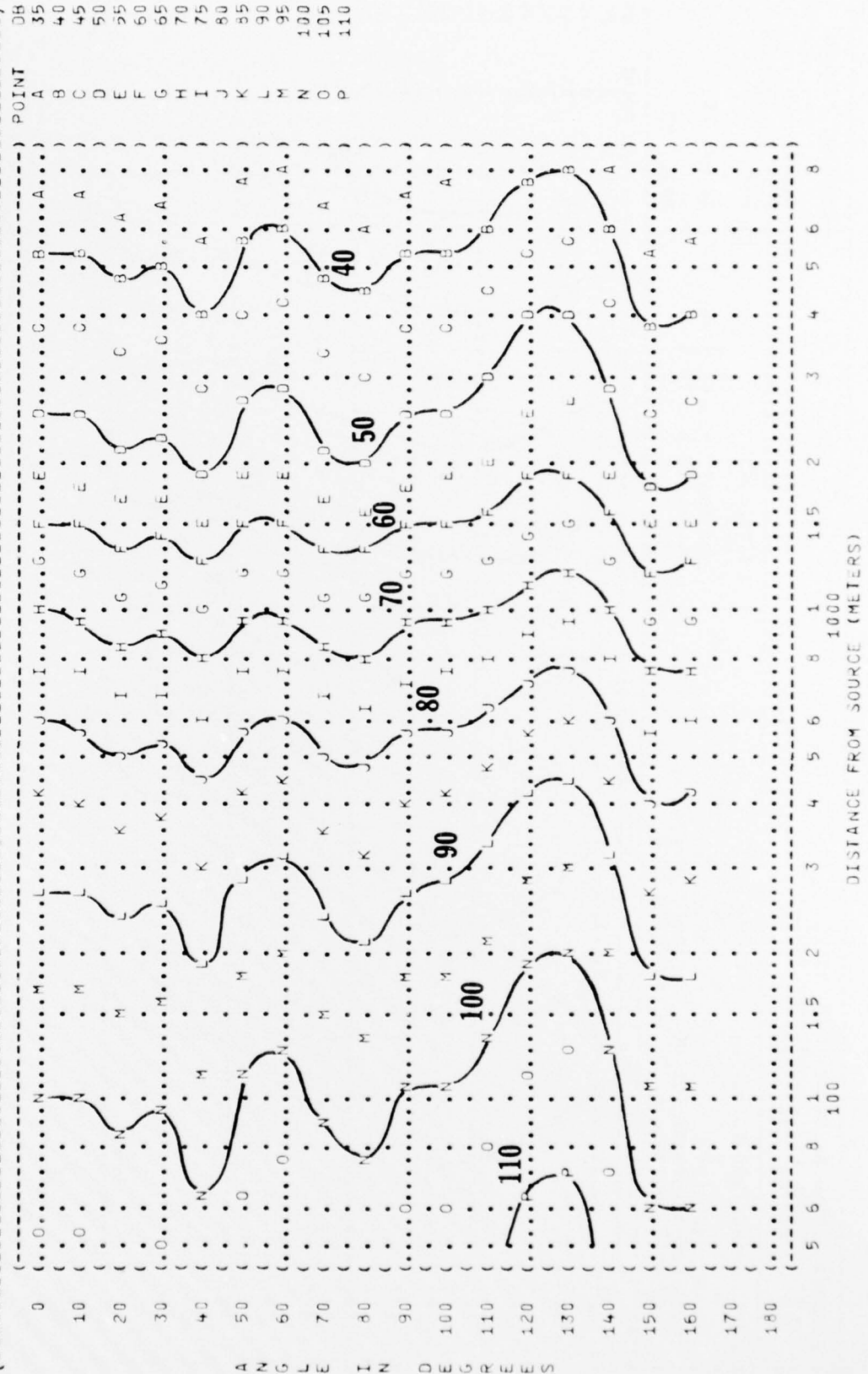
( FIGURE: SOUND PRESSURE LEVEL (SPL)  
 ( ( 11 EQUAL LEVEL CONTOURS (DB)  
 ( ( 63 HZ OCTAVE BAND  
 ( NOISE SOURCE/SUBJECT: ( OPERATION: ( METEOROLOGY: ( IDENTIFICATION: ( )  
 ( ( U-4B AIRCRAFT ( MILITARY POWER ( ) OMEGA 1.4  
 ( ( GSO-480-A1A6/B1A6 ENGINE ( 3400 RPM ( ) TEST 75-002-050  
 ( ( FAR FIELD NOISE ( 30TH ENGINES ( ) RUN 02  
 ( ( ( FREE FLOW ( ) 30 MAY 75  
 ( ( ( ( ) REL HUMID = 70 %  
 ( ( ( ( ) PAGE 19  
 ( ( ( ( )



( FIGURE: SOUND PRESSURE LEVEL (SPL)  
 ( 11 EQUAL LEVEL CONTOURS (03)  
 ( 125 HZ OCTAVE BAND  
 ( NOISE SOURCE/SUBJECT:  
 ( OPERATION:  
 ( MILITARY POWER  
 ( 3400 RPM  
 ( U-48 AIRCRAFT  
 ( GSO-480-A1A6/B1A6 ENGINE  
 ( FAR FIELD NOISE  
 ( BOTH ENGINES  
 ( FREE FLOW  
 ( METEOROLOGY:  
 ( TEMP = 15 C  
 ( BAR PRESS = .760 M HG  
 ( REL HUMID = 70 %  
 ( IDENTIFICATION:  
 ( OMEGA 1.4  
 ( TEST 75-002-050  
 ( RUN 02  
 ( 30 MAY 75  
 ( PAGE 20

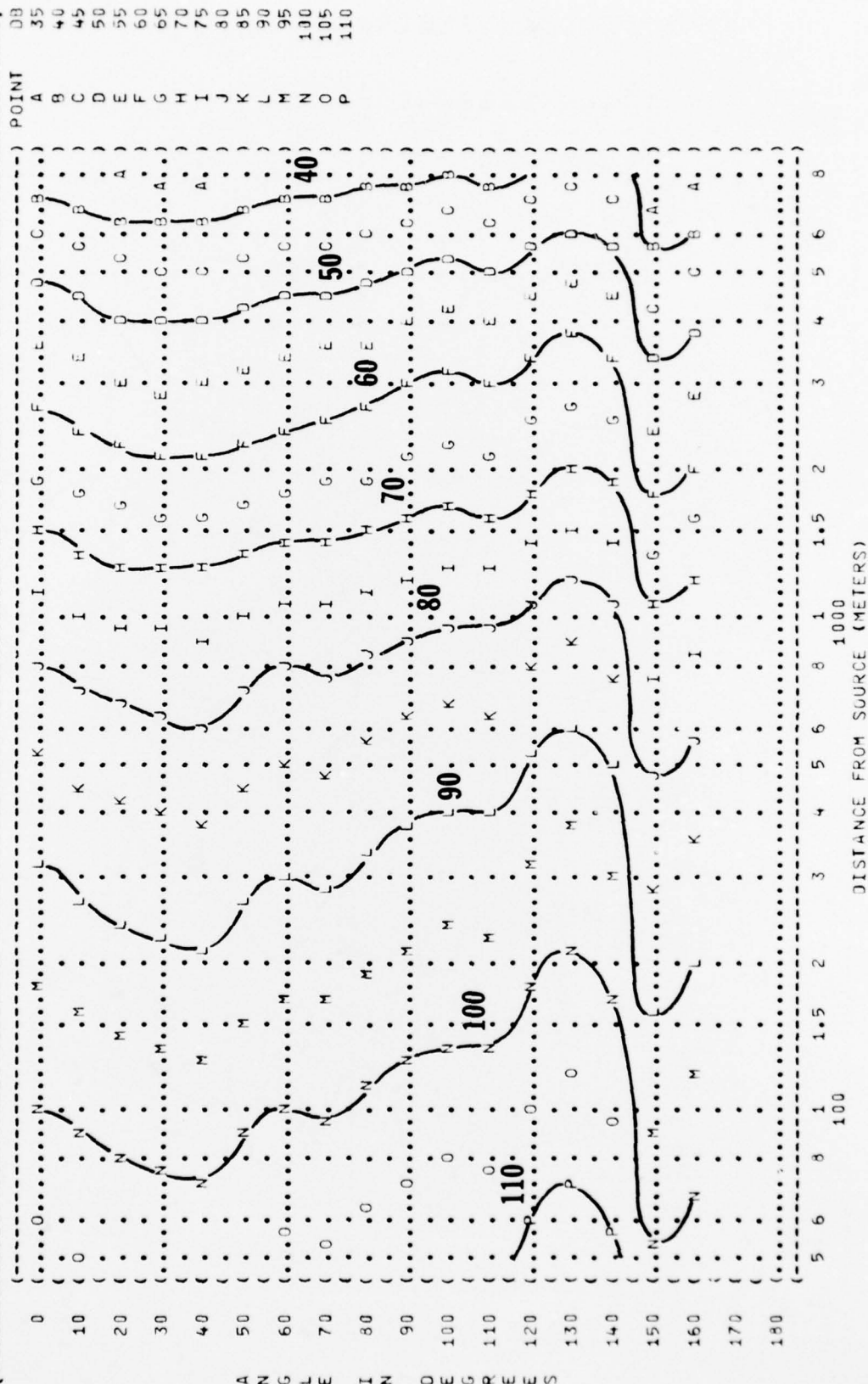


( FIGURE: SOUND PRESSURE LEVEL (SPL) )  
 ( 11 EQUAL LEVEL CONTOURS (DB) )  
 ( 250 HZ OCTAVE BAND )  
 ( NOISE SOURCE/SUBJECT: )  
 ( U-48 AIRCRAFT )  
 ( GSO-480-A1146/B1A6 ENGINE )  
 ( FAR FIELD NOISE )  
 ( OPERATION: )  
 ( MILITARY POWER )  
 ( 3400 RPM )  
 ( BOTH ENGINES )  
 ( FREE FLOW )  
 ( METEOROLOGY: )  
 ( TEMP = 15 C )  
 ( BAR PRESS = .760 M HG )  
 ( REL HUMID = 70 % )  
 ( IDENTIFICATION: )  
 ( OMEGA 1.4 )  
 ( TEST 75-002-050 )  
 ( RUN 02 )  
 ( 30 MAY 75 )  
 ( PAGE 21 )



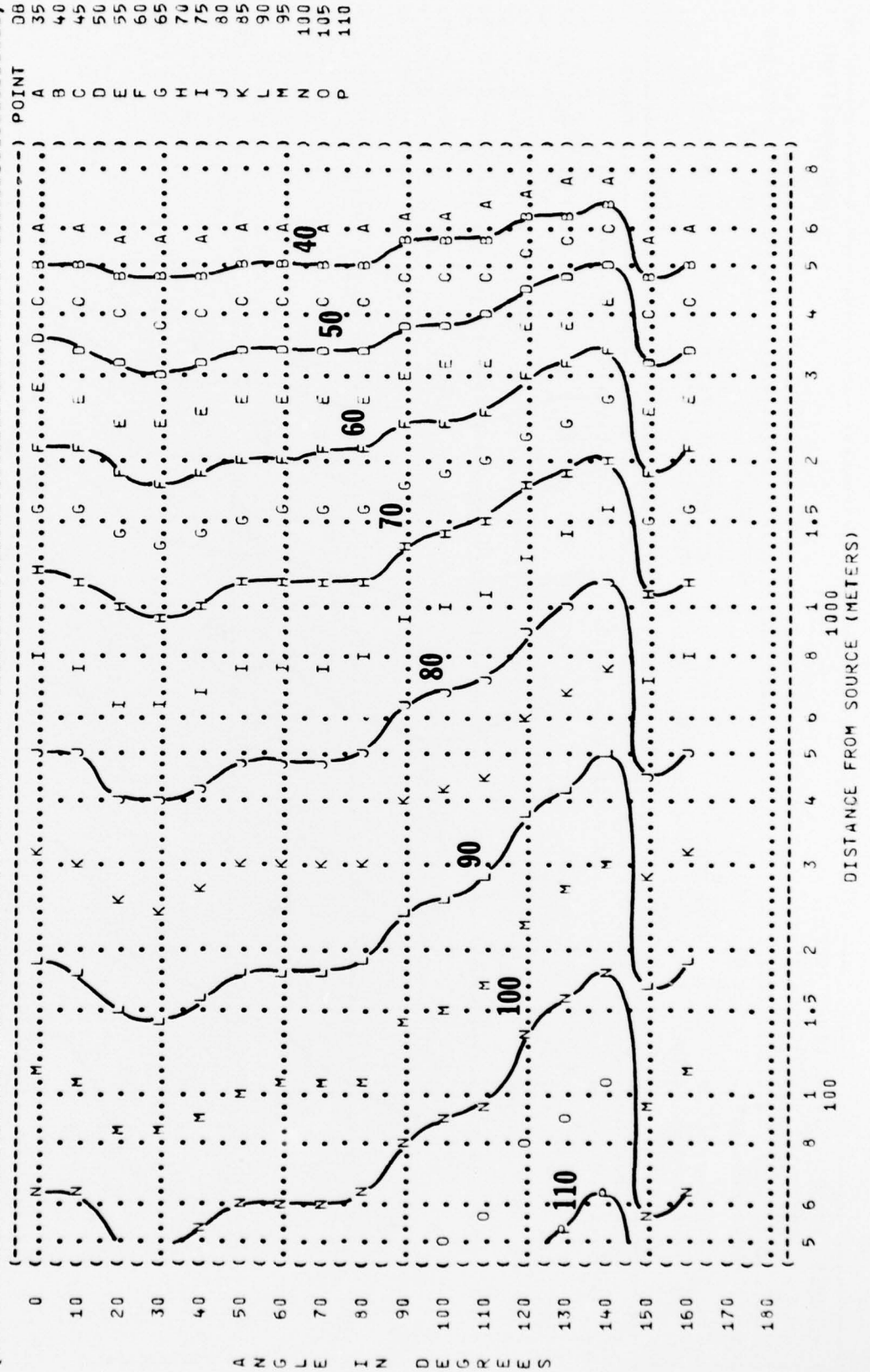


( FIGURE: SOUND PRESSURE LEVEL (SPL) )  
 ( 11 EQUAL LEVEL CONTOURS (DB) )  
 ( 500 HZ OCTAVE BAND )  
 ( NOISE SOURCE/SUBJECT: )  
 ( OPERATION: )  
 ( MILITARY POWER )  
 ( 3400 RPM )  
 ( BOTH ENGINES )  
 ( FREE FLOW )  
 ( U-4B AIRCRAFT )  
 ( GSO-430-A1A6/B1A6 ENGINE )  
 ( FAR FIELD NOISE )  
 ( METEOROLOGY: )  
 ( TEMP = 15 C )  
 ( BAR PRESS = .760 M HG )  
 ( REL HUMID = 70 % )  
 ( IDENTIFICATION: )  
 ( OMEGA 1.4 )  
 ( TEST 75-002-050 )  
 ( RUN 02 )  
 ( 30 MAY 75 )  
 ( PAGE 22 )





( FIGURE: SOUND PRESSURE LEVEL (SPL) )  
 ( EQUAL LEVEL CONTOURS (DB) )  
 ( 11 1000 HZ OCTAVE BAND )  
 ( NOISE SOURCE/SUBJECT: )  
 ( OPERATION: )  
 ( MILITARY POWER )  
 ( 3400 RPM )  
 ( GSO-480-A1A6/B1A6 ENGINE )  
 ( FAR FIELD NOISE )  
 ( BOTH ENGINES )  
 ( FREE FLOW )  
 ( METEOROLOGY: )  
 ( TEMP = 15 C )  
 ( BAR PRESS = .760 M HG )  
 ( REL HUMID = 70 % )  
 ( 30 MAY 75 )  
 ( RUN 02 )  
 ( TEST 75-002-050 )  
 ( OMEGA 1.4 )  
 ( IDENTIFICATION: )  
 ( PAGE 23 )



```
IDENTIFICATION:
)
) OMEGA 1.4
) TEST 75-002-050
) RUN 02
)
) 30 MAY 75
)
) PAGE 24
)
```

## ● METEOROLOGY:

TEMP = 15 C  
BAR PRESS = .760 M HG  
REL HUMID = 70 %

RUN 02  
30 MAY 75  
PAGE 24





( FIGURE: SOUND PRESSURE LEVEL (SPL) )  
 ( 11 EQUAL LEVEL CONTOURS (DB) )  
 ( 8000 HZ OCTAVE BAND )  
 ( NOISE SOURCE/SUBJECT: )  
 ( OPERATION: )  
 ( U-4B AIRCRAFT )  
 ( GSO-480-A1A6/31A6 ENGINE )  
 ( FAR FIELD NOISE )  
 ( MILITARY POWER )  
 ( 3400 RPM )  
 ( 80TH ENGINES )  
 ( FREE FLOW )  
 ( METEOROLOGY: )  
 ( TEMP = 15 C )  
 ( BAR PRESS = .760 M HG )  
 ( REL HUMID = 70 % )  
 ( IDENTIFICATION: )  
 ( OMEGA 1.4 )  
 ( TEST 75-002-050 )  
 ( RUN 02 )  
 ( 30 MAY 75 )  
 ( PAGE 26 )

